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ARMY RESEARCH AND DEVELOPMENT

October-November 1972

ABMDA
Research Center
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SPEAKING ON . . .

Future missile research and development, objectives in 'Big 5' materiel programs

Assistant Secretary of the Army (R&D) Robert L. Johnson discussed "Future Army Missile Research and Development Programs," but mentioned the Big Five Programs in Army R&D rating top priority, when he spoke at a meeting of the Association of the U.S. Army at Redstone (Ala.) Arsenal, HQ of the Army Missile Command. His address follows:

Robert L. Johnson

★ ★ ★

In covering future Army missile research and development programs, I will consider two general kinds of missiles and then talk about some common concerns with respect to Army R&D and certain areas that need our priority attention.

So first let's talk about programs. The two types of missiles that I will discuss are general-purpose missile systems and strategic missile systems, namely ABM. In general-purpose systems, the Army has established what it calls its Big Five Programs, which include other than missile systems and when established will receive priority for R&D funds. Two of these Big Five Programs involve missile systems in one form or another.

The first is our advanced attack helicopter. Our Vietnam experience with the two TOW-equipped UH-1 helicopters, as well as with Cheyenne tests, continues to make it clear that the advanced attack helicopter must be equipped with a TOW missile system.

However, in looking to the future, one recognizes that the TOW system requires that the helicopter stay exposed, even though perhaps from a very low mask, for the period of missile guidance. Therefore, we are now working upon what is called HELLFIRE system.

HELLFIRE is a laser-guided semiactive system that will permit the helicopter to take evasive action immediately after launch, assuming that the laser designation is done from another source. This system would probably have a somewhat longer range than the three kilometers of the TOW and of course, therefore, may be a little heavier.

The next Big Five missile system is the SAM-D, our newest air defense system, which is intended eventually to replace the Hercules and the Hawk. SAM-D's much greater capabilities, in terms of multiple engagement, operation in a severe electromagnetic countermeasures environment, and, as importantly, the reduced number of people required to operate an effective defense, make it a very attractive system.

I should note that some concerns have been expressed about the SAM-D with respect to a possible antiballistic missile capability and a possible apparent conflict with the SALT agreement. There is no longer any concern in this regard.

The other three systems of the Army Big Five are the new Mechanized Infantry Combat Vehicle, the new UTTAS utility lift transport, and the new Main Battle Tank.

There are, however, other very important missile programs that need to be covered. The first general type to be mentioned is the anti-tank group. The TOW is, of course, through development, but we urgently need a night sight for operation with that system.

The second is Dragon, which is almost through its missile development but also requires the introduction of a night sight. The importance of these sights to extend the battlefield day through the hours of darkness is clear.

The next general types of missiles to be considered are surface-to-surface. We are in the course of fielding the Lance nuclear version, but there must be significant activity upon the nonnuclear version of the Lance in order to reduce its cost so that it can be utilized in more circumstances.

In this regard, there is clearly a future requirement for a less costly Lance replacement or at least a much lower-cost version of the nonnuclear Lance.

Coming up with respect to the Pershing II system is the so-called RADAG (Radar Area Correlation Guidance). The product-improved Pershing utilizes terminal homing to reduce considerably the size of the required nuclear warhead, with a consequently great reduction in collateral damage.

In the air defense area, the Stinger is an improvement to the Redeye, enabling head-on attack and the attack on faster aircraft. Possible competitors to a Stinger, in terms of reducing any possible infrared countermeasures and the reduction of cost, need to be mentioned.

Also in the area of air defense is the probable use of short-range foreign systems to undergird a SAM-D defense. These newly developed or nearly developed systems, the Crotale, the Rapier or the Roland II, all have characteristics very similar to our Mauler of some years ago, but have managed to achieve that with the required high reliability and low cost.

In the area of the strategic systems, the Safeguard site at Grand Forks, approved by Congress, will provide us with some defense of the Minuteman, as well as a very valuable experience in terms of logistics, training, and operation of a 24-hour antiballistic missile defense.

The request that such a defense also be placed around the National Capital Authority will involve a considerable amount of development to adapt the Safeguard to such a site. In terms of the Site Defense, formerly the Site Defense of Minuteman and before that called Hardsite, the whole activity is basically R&D in terms of providing a prototype demonstration of the characteristics of such a system.

Recently noted is the importance of being able to rapidly deploy such a system. There will be considerable additional activity associated with establishing versions of the Site Defense which permit such rapid deployment.

Our other major antiballistic missile activity is our advanced ballistic missile defense activity work. This provides the base for the forward-looking aspects of Safeguard and Site Defense, as well as the technology and system planning base for forward looking systems. A major activity will be associated with looking at ways to provide defense against light attacks for large areas so that a possible destabilizing situation in the future can be avoided.

Clearly, no deployment decision has been made for these future light area defense systems but we must provide the technology upon which such systems could be based. Furthermore, the extension of this technology may provide the base for a future set of agreements following along our SALT approaches.

These, then, represent the major missile systems that we must consider. I noted that in developing them there are common concerns requiring the priority attention of both the military services and the contractors involved.

The problems are: shortening the elapsed time between the statement of the requirement and the realization by initial operational capability of that required capability; reduction of the cost

(Continued on page 31)

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FLARE

ARMY RESEARCH AND DEVELOPMENT

ABOUT THE COVER . . .

An integral part of advanced research in ballistic missile defense is the recently established ABMDA (Army Ballistic Missile Defense Agency) Research Center, whose ultra-speed computer capability is depicted on the front cover as it reacts to a simulated battle scenario.

On the back cover (top), an artist's concept of the computer screen shows three hostile vehicles (arrows from the right) approaching the United States being intercepted by RVs (arrows from left) launched from the American continent. Nuclear bursts are designated by the small circles at the point of interception. At the bottom is a graphic illustration of this simulated interception as viewed from the North Pole.

Editor . . . . **Clarence T. Smith**
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Published monthly by the U.S. Army R&D Information Systems Office, Office of the Chief of Research and Development, Department of the Army, Washington, D.C. 20310, in coordination with the Technical and Industrial Liaison Team, OCRD. Grateful acknowledgment is made for the valuable assistance of Information Offices within the U.S. Army Materiel Command, U.S. Continental Army Command, U.S. Army Combat Developments Command, Office of the Chief of Engineers, and Office of the Surgeon General. Use of funds for printing of this publication has been approved by Department of the Army, May 1, 1970.

Purpose: To improve informal communication among all segments of the Army scientific community and other Government R&D agencies; to further understanding of Army R&D progress, problem areas and program planning; to stimulate more closely integrated and coordinated effort among Army R&D activities; to express views of leaders, as pertinent to their responsibilities, and to keep personnel informed on matters germane to their welfare and pride of service.

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Submission of Material: All articles submitted for publication must be channeled through the technical liaison or public information officer at installation or command level.

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Distribution on an individual name basis is restricted to members of the U.S. Army Atomic Energy and R&D Officer Programs and to R&D Mobilization Designees. Otherwise, distribution is made only to the Army installation, office or organizational element to which the requester is assigned.

CHANGES OF ADDRESS for R&D and AE Officer Program enrollees should be addressed to HQDA (DARD-AO), Washington, D.C. 20310. R&D Mobilization Designees should report changes of address to Commanding General, USARCPAC, ATTN: AGUZ-CMD-MC, P.O. Box 12467, Olivette Branch, St. Louis, Mo. 63132.

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Selective Scanner . . .

Research on Helicopter Twist Rotor Scheduled

Experimental research on a new helicopter rotor system called the Controllable Twist Rotor (CTR) will be conducted under contract with the Army Air Mobility Research and Development Laboratory, Fort Eustis, Va.

CTR is a rotor system which uses two independent blade pitch control systems for each blade—a mechanical control at the root and a flap control at the tip.

In addition to controlling conventionally the aircraft's flight path, these two controls can also be programed for the desired blade twist, enabling the helicopter to fly faster, more efficiently and with more load for a given rotor size. Reduced vibration and a smoother ride are also predicted.

Kaman Aerospace Corp., granted a $742,000 contract by the Fort Eustis Directorate, will design and build a large-scale model system and whirl test it at their Bloomfield, Conn., facility over a 2-year period. Then the rotor will be sent to the U.S. Army Air Mobility Research and Development Laboratory, Moffett Field, Calif., for additional tests in the National Aeronautics and Space Administration (NASA)-Ames 40′ × 80′ wind tunnel.

Some form of this control system may be adapted to advanced rotor systems for the late 1970s, if the CTR tests work out as planned.

MERDC Develops New Modular Camouflage Net

Rapid camouflage of weapons and equipment is possible with a synthetic screening system developed by the U.S. Army Materiel Command's Mobility Equipment Research and Development Center, Fort Belvoir, Va.

The principal components are a basic hexagonal net covering 900 square feet and a diamond-shaped filler net to maintain symmetry when two or more hexagonal nets are joined.

Fabricated of polyester garnished with polyvinyl-chloride-coated spun-bonded nylon, each net is equipped with quick connect-disconnect devices. Two basic and filler nets can be joined in five minutes, with additions in less time. One module, including a basic and filler net and a repair kit is designed to weigh 50 pounds with carrying case.

Designed to provide concealment from visual, radar, photographic, and near-infrared detection, the screening system will be provided in color combinations for use in woodland, desert and snow areas. It is reversible to seasonal and color differences existing in nature.

The system permits easier and more rapid handling than the large assortment of sizes, shapes, and color blends found in the current standard burlap-garnished cotton twine nets. It also offers advantages in durability, and resistance to water and oil absorption.

Engineering and service tests on the woodland version are being completed at the Army Test and Evaluation Command.

YPG Chosen as Test Site for A-4N Skyhawk II

Yuma Proving Ground (YPG), Ariz., has been selected as the site for bombing tests of the McDonnell Douglas A-4N Skyhawk II, developed for the Israeli Air Force.

Utilizing a laser aircraft tracker as well as facilities of YPG's Cibola Instrumented Aircraft Test Range, the tests are scheduled to begin in November and continue for several weeks.

Giant circles scraped on the desert floor at Cibola Range, where the Los Angeles wash cuts through the middle mountains, will serve as targets for bomb drops.

Basically, this aircraft has the same airframe and engine as the A-4N now operated by the U.S. Marine Corps. Modifications include a new inertial navigation/weapons delivery system, two 30mm cannons, and a redesigned cockpit layout including a "head-up" display weapons delivery system operation.

Electron Microscope Test Specimen Developed

Development of a test specimen for evaluating the resolving capabilities of scanning electron microscopes (SEM) has been announced by the National Bureau of Standards (NBS).

The specimen, a dendritic crystal growth on the facets of an aluminum-tungsten bead, is the result of extensive studies by D. B. Ballard, Metallurgy Division of NBS. Discovery of the specimen was found by melting aluminum with a hot tungsten filament in a vacuum.

Advantages of the sample for SEM tests include: high secondary emission and contrast; no loose particles; elimination of outgassing; nonmagnetic consistency; no adverse reaction to the electron beam; accurate adjustment of the stigmator; a varying structure-spacing suitable for high- and low-resolution testing; and reproducible capabilities.

NBS Develops New Optics Evaluation System

An improved method for lens testing developed at the National Bureau of Standards (NBS) uses an optical autocorrelator based on a modified Sagnac interferometer to measure the optical transfer (OTF) or spatial frequency response of an imaging system.

OTF measurements with the NBS system combine the accuracy of focus and alignment provided by interferometric testing with a real-time output. The method is not limited in focal length, and aperture size is limited only by the surface area of the beam splitters and mirrors used.

In its present form, the apparatus is theoretically capable of testing systems with spatial frequency cutoffs of up to approximately 500mm^{-1} (above f/3), accurate to within two percent. Data obtained with the autocorrelator reportedly compare very favorably with those obtained using a sine-wave bench. It also appears capable of testing higher frequency optical systems with better accuracy than equipment currently used.

Basically, the NBS autocorrelator for testing lenses at infinite conjugates consists of a HeNe laser, beam splitter and two mirrors, the latter two components forming a Sagnac interferometer.

Conventional methods of measuring the OTF generally fall into one of two categories: frequency analysis of a target image of known content; or interferometric determination of the lens aberrations from which the OTF may be calculated.

Airborne C-E Board Aids POs With Test Photos

To enable project officers to obtain needed information on test techniques, operation and performance, the U.S. Army Airborne, Communications and Electronics Board, Fort Bragg, N.C., photographs its expanded service testing in both motion picture and still photography.

A Photographic Branch of the Logistics Division provides all types of photographic services for analysis, instrumentation, and historical purposes.

Furnishing essential air-to-air coverage of airborne testing as well as ground-to-air coverage on the drop zone, the branch uses a well-equipped laboratory to expedite processing of black and white and color stills and motion pictures.

Multiple high-speed camera is set up to obtain ground-to-air coverage of an airborne equipment drop at Fort Bragg, N.C. The camera is a 16mm DBM 54 equipped with a 6- and 20-inch telephoto lens capable of taking as high as 400 pictures a second.

Viking Martian Lander Passes Tests at WSMR

The third test of a balloon-launched simulated Viking entry vehicle was successfully carried out late in September by the National Aeronautics and Space Administration (NASA) over the White Sands (N. Mex.) Missile Range (WSMR).

Supersonic test conditions of the first test on July 11 were repeated. Results demonstrated the deceleration capability of the parachute system at the highest speed and most severe loading conditions expected in the Martian atmosphere during the Mars landing planned for 1976.

In the first test, NASA reported that test conditions were exceeded although some parachute damage occurred. The second test over WSMR July 26 checked the parachute system at transonic conditions and at the lowest parachute loading conditions expected over Mars. Results indicated that the system had performed completely satisfactorily.

The third test used a huge helium-filled balloon flown to an altitude of about 120,000 feet over WSMR. The test spacecraft was then separated from the balloon on radio command from WSMR Range Control.

Spacecraft rocket motors then were ignited, boosting the test vehicle to an altitude of about 149,000 feet where the velocity achieved test conditions expected over Mars. Here the parachute deployed to decelerate the simulated Viking spacecraft. The test terminated when the parachute system landed the test vehicle on WSMR.

Preliminary analysis of quick-look data by project technical personnel indicated that all test conditions were met and all systems operated as planned.

Cobra Armament System Test Scheduled

Testing of the Improved Cobra Armament System is scheduled to begin next spring at Yuma Proving Ground (YPG), Ariz.

In announcing the program, Technical Adviser Floyd E. Watts said the Army Preliminary Evaluation II (APE II) test will be planned and conducted by YPG's Aircraft Armament Engineering Branch beginning in April 1973.

It will include testing of the TOW (Tube-launched, Optically-tracked, Wire-guided) missile system as well as the Helmet Sight System for the AH-1G Huey Cobra gunship helicopter in accordance with military standards and Army materiel needs.

Contractor testing, however, is slated to begin this December. About 13 office and an undetermined number of support personnel are expected to be on hand from Bell Helicopter Co., developer of the "HueyCobra"; Hughes Aircraft Co., manufacturer of the TOW missile and system; and Sperry Gyroscope Co., manufacturer of the Helmet Sight.

Engineering and expanded service tests, to determine suitability for Army use, are scheduled to be held from September 1973 through February 1974.

Because of the previous Vietnam success with the Huey gunships equipped with the airborne TOW, the Army is confident that the integrated TOW-Cobra system is a low risk effort.

Research and testing for the airborne, wire-guided missile are expected to cost nearly $30 million.

U.S., Canada Join in Evaluating Arctic Radar

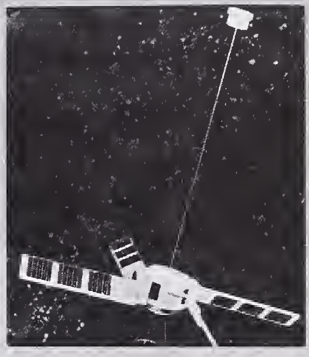
The Canadian Arctic will be the site of a joint United States-Canadian evaluation of over-the-horizon (OTH) radar scheduled to begin this fall for a year-long period.

Polar Cap III will be installed by the U.S. Air Force at Hall Beach on the Melville Peninsula, Canada, to test experimentally the latest developments in OTH backscatter radar systems.

The research and development project is expected to provide valuable test data to scientists in both countries for determining the feasibility of locating such radars in Arctic regions.

The Canadian Defense Research Board plans to operate a complementary radar receiver at Cambridge Bay on Victoria Island in conjunction with the Polar Cap Program.

Navy Transit Satellite Improves Navigation



Improved all-weather global navigation, charting of offshore oil and mineral deposits, and land survey projects are being accomplished by a U.S. Navy transit satellite placed in a near-polar orbit in September to serve military and commercial users.

Powered by a 30-watt atomic generator, the 207-pound satellite is transmitting experimental data on nominal frequencies of 400 and 150 MHz during a 6-month experimental phase. When available for general service, users with equipment that can receive signals from the operational satellites will be able to obtain fixes from it in the same manner as with current navigational systems.

As a satellite approaches a ground station, or ship, its signal activates the receiving equipment, which then automatically computes and types the ship's position for the navigator.

A unit called DISCOS (disturbance compensation system) forces it to fly a highly predictable orbit. Success of this feature may lead to navigation satellites whose orbit is so precise and unchanging that their paths can be published in reference tables.

Such tables would make it possible to use simpler and less costly ground equipment to calculate navigation fixes. Orbit predictions for the present satellites must be updated every 12 to 16 hours and fed to the satellite memory for rebroadcast to users.

Examples of the system's accuracy have been the pinpoint pre-positioning of Navy ships preparing to recover astronauts from orbit.

Fort Eustis Tests New Control Components

Manufacturing methods technology for ballistic damage tolerant replacement flight control components will be developed for the U.S. Army Air Mobility Research and Development Laboratory, Fort Eustis, Va., under a $98,000 contract.

Project engineer MAJ Llayll A. Fry said the objective is to develop a capability to mass produce reliable, repeatable, low-weight, low-cost flight control components made of fiberglass reinforced composite materials.

Since helicopter flight control systems are highly vulnerable to ballistic damage, this material offers one possible solution to the development of lightweight, damage-tolerant components.

Design and technical data obtained in R&D studies will be reviewed by Whittaker Corp. The firm will also modify designs and materials as needed to get cost-effective production, and provide mass production technology.

The contract includes design and development of tape lay-up programs, cloth lay-up techniques, matched metal mold processes, or a combination of these, plus special tools and manufacturing equipment needed.

Testing will include fatigue, structural, ballistic and environmental tests covering humidity, dust, oil and temperatures.

University Seeks Reactor for Training

The University of Virginia has requested a construction permit from the Atomic Energy Commission to install a low-power training reactor on its Charlottesville campus.

As proposed, the reactor will operate at a maximum power level of 100 watts and will be housed in an aluminum-lined concrete pit at ground level of the new addition to the University's reactor building.

The primary purpose of installing the reactor is to provide a safe and convenient facility for student laboratory training, which would free the University's 1-megawatt research reactor for full-time experimental use.

Project REFLEX . . .

Defense Effort to Improve Management Extended to 12 Additional Army Labs

Extending the Department of Defense Project REFLEX (Demonstration Project on Reconciliation of Workload, Funds and Manpower), the U.S. Army recently placed 12 additional in-house laboratories under the concept for a 3-year test.

Emphasizing the use of fiscal constraints alone, instead of both fiscal and manpower management controls, the REFLEX concept gives directors/commanders of participating research, development, test and evaluation activities maximum managing flexibility.

Initiated in July 1970, the original DoD experiment involves 10 in-house laboratories from the military services, including four Army laboratories: Harry Diamond Laboratories, Washington, D.C.; Electronics Command R&D Laboratories, Fort Monmouth, N.J.; Mobility Equipment R&D Center, Fort Belvoir, Va.; and the Air Mobility R&D Laboratory, Moffet Field, Calif.

Appraisals of the first year of experimentation indicated that substantial improvements in management philosophy, as well as economies in applying fiscal and personnel resources to programed tasks, were achieved by the Army Materiel Command (AMC) labs.

The Army REFLEX laboratory directors involved in the DoD experiment have endorsed the concept. Reportedly, one of the most significant benefits of the experiment has been the change in management philosophy.

Previously, the annual program and budget management decisions were based on the need to justify separately program funds while concurrently protecting allocated spaces and grade levels. This was an outgrowth of the dual channels for funds and manpower.

During the DoD experiment, the REFLEX managers learned that they were no longer tied to the burdensome administrative mechanism required to justify their personnel assets and organizational structure.

Under REFLEX, success depends on how effectively funds are allocated to achieve program objectives. Consequently, REFLEX managers look at salaries as a cost that can be adjusted for maximum effectiveness as opposed to being an unchangeable fact of life.

Reports from laboratory directors state that skills have been used more effectively, morale has improved among the younger scientists and engineers, and new opportunities have been introduced at lower grades.

The Army extension of Project REFLEX, to be called REFLEX (Army), proposes to capitalize on these improvements in management philosophy and operational efficiencies by extending the concept to additional RDT&E activities.

Objectives of REFLEX (Army) are (1) to evaluate further the feasibility of managing RDT&E activities through the fiscal control channel alone as opposed to both the fiscal and manpower control channels; and (2) to determine if the concept, as implemented by DoD, can be accommodated within a civilian manpower environment which constrains the Army and developing agencies to an over-all numerical ceiling.

In formulating the Army test, it was recognized that concern over the number of federal employes has been, and likely will continue to be, a recurring problem. The extension test therefore was designed to accommodate the possibility that the Army may have to operate within numerical manpower ceilings or other constraints on civilian direct hire employment levels.

Even with the imposition of manpower ceilings, the REFLEX concept permits laboratory directors significant additional flexibility (and responsibility) in the management of his program. If there are no manpower ceiling constraints in effect, REFLEX (Army) is similar to the original DoD experiment.

Each approved REFLEX (Army) activity will operate under the test conditions for three years, to provide sufficient time for initial adjustment and response. Experience with the DoD experiment indicates that at least two complete budget cycles beyond the date of entry into the test are necessary for realistic assessment. Because of the unique time base, intra-Army nature and the civilian manpower situation, REFLEX (Army) will be maintained separate and distinct from the DoD experiment.

In the Army test, authority delegated to directors/commanders of RDT&E activities is used to determine the most cost-effective allocation of fiscal resources, including in-house manpower costs necessary to accomplish the desired program.

The test will use budget-cycle documentation to project, approve and allocate the interdependent fiscal and manpower resources needed to accomplish specific programs. Manpower control will be maintained at the operating level through approval of the proposed budget program resource requirement.

REFLEX (Army) activities will determine their manpower requirements in response to budget guidance. The manpower portion of the annual budget estimates submitted by the RDT&E activity under test will be the basis for reporting manpower requirements. It will also act as the initial agreement between the developing agency and the activity on expected manning levels for permanent and temporary part-time positions needed.

In issuing instructions for the test, the Army has directed R&D headquarters and force development staffs to be alert to the in-house manpower requirements of emerging or changing programs that will affect subordinate activity estimates.

When program changes require an increase in manpower by the REFLEX (Army) activity, affecting agency or Army ceilings, estimates will be coordinated by the developing agency with the Department of the Army. RDT&E activities will be expected to stay within their manpower estimates for approved budget programs.

Flexibility will be provided within over-all Army and agency ceilings by withdrawing activity manpower allocations upon entering the test and pooling them at developing agency level. Adjustments will be made in the agency pool by incorporating the manpower projections associated with subsequent budget program submissions.

Management controls will be limited to the fiscal channel by exempting REFLEX (Army) activities from certain requirements imposed by the manpower channel.

In addition to determining and establishing their own manpower allocation in response to program and budget guidance, activity directors are being given authority to change and approve their own TDA (Tables of Distribution and Allowances), subject to appropriate staffing guides and regulations. U.S. Civil Service Commission procedures and control of GS grade escalation are not affected by REFLEX (Army).

Manpower surveys for the laboratories involved will be suspended, except as initiated by local directors to determine the most effective balance and utilization of personnel resources. Before a developing agency enters the test, it may have to conduct a manpower survey to obtain a picture with respect to validated authorizations and requirements.

The Army expects that success under REFLEX will depend on how effectively line managers apply fiscal resources to program tasks. While salary costs under REFLEX are not keyed to a fixed organization, they are limiting factors to the efficient fulfillment of program objectives.

RDT&E activities involved in REFLEX (Army) will continue to maintain a reasonable balance of in-house to contractual effort. This does not mean that each activity must have a precise ratio at all times. Variations between situations will require that sound management judgment be exercised almost on a case-by-case basis.

The REFLEX (Army) experiment will undergo appraisals: (1) of the reactions of the customers of activities involved (project managers, commodity commands, etc.); (2) by each of the activity directors who will be expected to assess progress and make their own independent evaluation of the impact of increased flexibility and responsibility; and (3) supervisory, which will include an appraisal through the chain of command measured against pre-established goals and objectives.

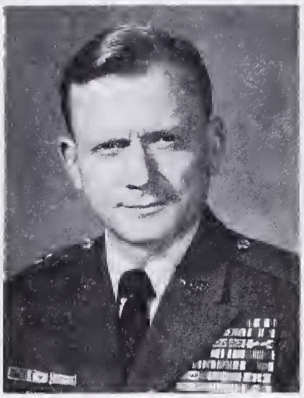
Activities selected for REFLEX (Army) are:

Army Materiel Command—Army Materials and Mechanics Research Center, Watertown, Mass.; Aberdeen Research and Development Center (Ballistic Research Laboratories, Human Engineering Laboratories), Aberdeen (Md.) Proving Ground; Natick (Mass.) Laboratories; Directorate for Research, Development and Engineering, and Missile Systems Laboratory, U.S. Army Missile Command, Redstone Arsenal, Ala.; Mobility Systems Laboratory, U.S. Army Tank-Automotive Command, Warren, Mich.; Weapons Laboratory, U.S. Army Weapons Command, Rock Island Arsenal, Ill.; and Benet Research and Engineering Laboratory, U.S. Army Weapons Command, Watervliet Arsenal, N.Y.

Corps of Engineers—Cold Regions Research and Engineering Laboratory, Hanover, N.H.; Waterways Experiment Station, Vicksburg, Miss.; Construction Engineering Research Laboratory, Champaign, Ill.; and the Engineer Topographic Labs, Fort Belvoir, Va.

Office of the Chief of R&D —U.S. Army Research Institute for the Behavioral and Social Sciences (formerly U.S. Army Manpower Resources R&D Center), Arlington, Va.

Army Research Office Phasing Out in OCRD Reorganization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COL James W. Barnett

LTC Alvin L. Meredith

LTC Theodore Gregory

COL Richard A. Rooth

Reorganization of the Directorate of Army Research within the Office of the Chief of Research and Development, Department of the Army, involves the inactivation of the U.S. Army Research Office (USARO), Arlington, Va.

Approved by the Army Chief of Staff, the reorganization plan is termed "an action to improve the effectiveness of the organization, separate staff and operating functions, and reduce the number of operating agencies in the National Capital Region."

General Staff functions of the Directorate of Army Research remain unchanged: to provide supervision of assigned programs in the basic research and exploratory development areas (categorized as 6.1 and 6.2 in the budgetary line item designations) and to provide an overview of the U.S. Army's technology base.

The directorate will provide staff supervision of development programs in meteorology, mapping and geodesy, medical equipment, and food processing. It also will exercise laboratory review functions and provide an interface with the Army in-house laboratories and the scientific community.

Operational functions will be centered largely in the U.S. Army Research Office, Durham, N.C., known by the acronym ARO-D, which like USARO in Arlington is a Class II Activity. ARO-D will be redesignated the U.S. Army Research Office, and will receive an additional 13 personnel spaces and 6 incumbents from the Arlington office to perform its expanded functions.

In the area of the behavioral and social sciences, operational functions are being transferred to a newly established U.S. Army Research Institute for the Behavioral and Social Sciences, known as ARI—a redesignation of the U.S. Army Manpower Resources Research and Development Center.

The ARI will assume the contracts, grants, program and budget functions that formerly were performed for the USARO Behavioral Sciences Division by the USARO Research Contracts and Grants Branch.

In a related but separate realignment of functions, Army studies related to research and development studies were transferred on Oct. 1 to the Coordinator of Army Studies in the Office of the Assistant Vice Chief of Staff, Department of the Army. Studies for the Army staff will be contracted by the Harry Diamond Laboratories, Washington, D.C.

Two divisions will comprise the headquarters organization of the Directorate of Army Research headed by BG Charles D. Daniel Jr., in which COL James W. Barnett is the deputy director, Dr. I. R. Hershner the scientific director, and LTC Alvin L. Meredith is the assistant director.

The Science and Technology Division established in April 1972 is redesignated as the Technology Division, with responsibility for laboratory review, coordination, and technology base overview. The division, headed by LTC Theodore Gregory, also will perform residual functions in research studies.

A new Science Division consists of four offices formerly designated as divisions in the USARO organization, namely: Physical and Engineering Sciences; Environmental Sciences; Life Sciences; and Behavioral Sciences. COL Barnett doubles as chief of the Science Division.

Dr. Robert W. Watson, who has served in the Physical and Engineering Sciences Division (formerly the Physical Sciences Division) since 1959 and has headed the Physical Sciences and Technology Branch, is the acting chief of the Physical and Engineering Sciences Office. This is a PL-313 position, the same grade held by Dr. Hershner and Dr. Desmond O'Connor.

Currently chief of the USARO Environmental Sciences Division, Dr. O'Connor continues as chief of the corresponding new office. Similarly, COL Garrison Rapmund continues as chief of the Life Sciences Office and COL Robert O. Viterna as chief of the Behavioral Sciences Office.

COL Richard A. Rooth is the director of the U.S. Army Research Institute of Social and Behavioral Sciences, which is destined to take on an increasingly major role in R&D pertaining to personnel and training problems of the Modern Volunteer Army.

What is now ARO-D and will be the U.S. Army Research Office will continue under the command of COL Lothrop Mittenthal, who has headed ARO-D since March 1972. COL Benedict L. Freund continues as commander of the U.S. Army R&D Group Europe and COL John D. Marshall Jr. remains as commander of the U.S. Army R&D Group Far East.

Dr. Lynn E Baker, U.S. Army chief psychologist for 15 years, will be assigned to the new ARI with temporary duty station in London, England.

Alvin D. Bedrosian, who was recently awarded a Department of the Army Decoration for Meritorious Civilian Service as chief of the Scientific Liaison Office for USARO in the Greater Boston (Mass.) Area, continues in that capacity.

The target date for completion of the reorganizational changes is Jan. 1, 1973,

(Continued on page 6)

AMC Laboratories Issue First Annual Posture Reports

In their first annual posture reports, 13 laboratories under the Army Materiel Command (AMC) have summarized a number of management innovations, technical staff quality advances, improvements in responsiveness, and technical productivity accomplishments.

Responding to a new AMC requirement aimed at enhancing their recognition, laboratories reported in terms of their usefulness and accomplishments. In the past, similar reports served principally as the foci of recurring management problems.

As directed by the AMC Deputy of Laboratories, the reports represent each laboratory's unclassified story covering at least minimum elements of information. Taken together, with an Executive Summary added, these reports are the AMC Annual Corporate Report on Laboratories.

These are an outgrowth of the annual reports prepared by some AMC laboratories in past years. Starting in FY 72, this procedure was extended in the form of posture reports to all AMC laboratory organizations.

Considered to be a productive means for the AMC laboratory community to assess its condition, the reports provide extensive information on technical achievements, funding, personnel and facilities.

Management of the laboratories was reviewed, highlighting missions, involvement, flexibility, plans, analyses and other issues. Salient subjects reported include the phasing-out of AMC's offensive biological warfare capability at Fort Detrick, Md., whose facilities were transferred to the Department of Health, Education and Welfare for cancer research.

The Lead Laboratory Concept, an important management tool, has been further refined by charters denoting laboratory assignments. There are presently 14 Lead Laboratories—that is laboratories with Army-wide responsibilities in specific research areas—within the Army Materiel Command.

To enhance the project manager-laboratory interface in the systems acquisition process, project managers have been directed to involve the laboratories more in their high-priority, high-visibility programs. At the same time, total AMC interaction is ensured by a series of technology reviews presented by the lead and associated laboratories to the commanding general, AMC, at least annually.

Flexibility, a characteristic of the management innovations, has been epitomized in Project REFLEX participation. This experiment in AMC has proved to be highly successful. (See separate article on page 4.)

The In-House Laboratory Independent Research (ILIR) Program, according to the reports, has become a highly flexible management tool for the laboratory director. It has provided him the means for exploring new ideas, retraining and upgrading personnel, and initiating worthwhile, unprogramed research.

Regarding plans, analyses and other issues, the reports allude to Technology Coordinating Papers (TCPs) prepared for the Department of Defense. AMC laboratories have participated in many and have been the lead service in several. For example, among them is one on land mobility recently initiated for the DoD by the U.S. Army Tank-Automotive Command (TACOM), Warren, Mich.

In personnel matters, the reports describe the continuing improvement in the quality of laboratory technical and staff leadership. Of approximately 15 recent additions to the AMC top technical leadership, 10 have been recruited from external organizations.

Recognizing the importance of a viable R&D Officer Career Program, the AMC has developed a plan to improve the distribution of qualified personnel throughout the command. A 200 percent increase in the number of potential general officer slots (from 2 to 6) has been proposed, along with an expansion of the base of company grade officers by 20 percent.

The Civilian Engineer and Scientist Career Planning Board membership was expanded during FY 72 to assure broader representation in establishing policy. The board now has representation from the Chief of Research and Development (CRD), Assistant Chief of Staff for Force Development (ACSFOR), Assistant Chief of Staff for Communications Electronics (ACSCE), Army Strategic Communications Command (STRATCOM), Combat Developments Command (CDC) and AMC.

Implementation of Project REFLEX in AMC laboratories, the reports show, has resulted in managerial and personnel improvements such as better integrated personnel and fiscal planning; increased cost consciousness; reduced job labor cost, including overtime; increased use of short-term hires; special staffing without stockpiling.

The ultimate payoff of laboratory operations is reflected in the technical contributions to Army materiel needs. This is measured in reduced production and maintenance cost and increased effectiveness. Some representative examples reported are:

- The Munitions Command explosive research program, culminating with new laboratory findings in FY 72, has saved about $54 million in bomb costs for the period from initial improvement some years ago through the anticipated FY 73 buy.
- The Weapons Command developed dynamic hydraulic tube life simulator resulted in a one-time saving of $3.5 million for the development of one category of cannon tubes.
- Harry Diamond Laboratories' pioneering work in fluidics is reflected in savings by fluidics control devices used in ammunition production.
- Air Mobility Research and Development Laboratory (AMRDL) estimates that installation of elastomeric bearings on main rotor heads of the Cobra and two models of the Huey helicopter, initiated during FY 72, will save about $10 million over the next 10 years.
- During FY 72, installation of the Crashworthy Fuel System (CWFS), developed by the AMRDL, on operational aircraft continued at an accelerated rate. This new system will be put in all current operational and future Army helicopters.

Other technical contributions to materiel requirements and the responsible agencies are:

Army Materials and Mechanics Research Center (AMMRC). An advanced precision casting method for highly reactive columbium alloys from which first-stage nozzle vanes were successfully cast for the T55 helicopter engine for the Army Aviation Systems Command (AVSCOM).

Air Mobility Research and Development Laboratory (AMRDL). Through the exploitation of new approaches in both theoretical and experimental studies, considerable progress has been made in understanding the unsteady aerodynamic problems which are unique to rotary-wing aircraft and are frequently responsible for limiting their operational capability.

Ballistic Research Laboratories (BRL). Devised a new concept of a technique for using materials for lightweight armor which

USARO Phasing Out in OCRD Reorganization

(Continued from page 5)

except for the physical move of USARO personnel to the Pentagon, where the Office of the Director of Army Research has always been located. The move is linked to the availability of space in the Pentagon, which involves a move of another agency into a new office building in Alexandria.

Forty-one of USARO's current authorized personnel spaces will be assigned to headquarters staff of the Director of Army Research creating a lean 59 man organization. As mentioned earlier, 13 other spaces will be transferred to the Army Research Office in Durham and a like number to the U.S. Army Research Institute for the Social and Behavioral Sciences. In addition to these transfers, there is a net reduction of 27 spaces.

The reorganization is being accomplished with a view to retaining within the Directorate of Army Research and its field elements the expertise and experience of the USARO professional staff. Assignments are being offered in other elements to those who will not be involved in the move to the Pentagon.

The Technology Division is staffed with 11 military personnel (all of them with advanced degrees as scientists and engineers), four civilian scientists and five clerical and stenographic personnel. The Science Division will have 12 military, 13 professional civilians and eight support personnel.

With the move to the Pentagon, a cycle extending over a 15-year period will be completed. What is now USARO in Arlington started out in 1957 as a small scientific staff in the Pentagon and a field unit at Fort Belvoir, Va.

The Pentagon staff was transferred to Fort Belvoir with the activation of USARO as approved by then Secretary of the Army Wilber Brucker, effective Mar. 24, 1958. USARO was moved to Arlington Hall Station, Va., in June 1958 and to the Highland Building in Arlington in May 1962.

provides improved protection against shaped charges.

Coating and Chemical Laboratory (CCL). An Antifreeze Corrosion Test Kit, developed to monitor the extended service life of military antifreeze solutions, has been approved for field use. It is expected to save $6 million in a 2-year period.

Harry Diamond Laboratories (HDL). The HDL has actively participated in the nuclear hardening of many Army systems. The Aurora gamma-ray simulator, funded by the Defense Nuclear Agency and operated by HDL, became operational in April 1972 and has been used to measure the vulnerability of the Spartan flight control system.

Army Electronics Command Laboratories (ECOM). The exploitation of integrated electronics, together with the use of higher efficiency neodymium materials, more efficient detectors, passive rather than mechanical Q switches, and improvements in flash lamps and battery supplies, has culminated in the demonstration of an experimental 5-pound laser rangefinder.

Mobility Equipment Research and Development Center (MERDC). An Engineering, Test/Expanded Service Test was completed on a prototype ribbon bridge designed by the MERDC. The bridge was type classified Standard-A less than three years from the start of development.

Missile Systems Laboratory (MICOM). Significant accomplishments were realized in hypervelocity technology for free-flight rockets. A booster and second stage were mated successfully with four successive firings, achieving four to six mil dispersion.

Army Munitions Command Laboratories (MUCOM). Application of scanning electron microscopy (SEM) to the fractographic analysis of recovered fragments has provided for the identification of fracture processes involved in explosive fragmentation.

Natick Laboratories. Substantial progress was made in the DoD food RDT&E program during FY 72. Although this program addressed past requirements of all military services and the Defense Supply Agency, primary support for the Army effort was focused on improvement of the garrison feeding system.

Army Tank-Automotive Command Laboratory (TACOM). An elevated Antitank Missile Launcher Test Rig was developed to demonstrate the concept feasibility of an advanced vehicle-mounted weapon system that can fire and guide a modern missile system from an elevated tracker assembly while the vehicle is in complete defilade.

Army Weapons Command Laboratories (WECOM). A new reflex sight for the M16 rifle was demonstrated. Field tests indicate that, when used by a cross-section of poor, average and good shooters, this sight will increase hit probability on stationary targets up to 30 percent, increase hit probability when firing from a moving vehicle or other unstable platform, and reduce training time.

These randomly selected examples show the increasing emphasis being placed on use of research to reduce the production cost of materiel. Many additional examples are described in AMC's recently published "Summary and Overview of Army Materiel Command Laboratories for Fiscal Year 1972," based on information in the annual posture reports submitted in September 1972.

General Research Corp. Buys RAC

Sale of the Research Analysis Corp. (RAC), established Sept. 1, 1961, as a major U.S. Army operations research contract agency, to the General Research Corp. has been announced.

Under terms of the agreement, the General Research Corp. (GRC), Santa Barbara, Calif., has absorbed RAC personnel and will continue to operate in the former RAC facilities in McLean, Va. Most of what was RAC is now the Operations Analysis Division of the General Research Corp. GRC. The price of assets purchased was approximately $90,000 including the purchase of components of the RAC computer system.

Negotiations leading to the purchase agreement were conducted over a period of several months following consideration of proposals from nine research organizations, one of which withdrew its offer. A special task group representative of the Department of Defense and the Department of the Army worked on the project.

Members of the group included Army Assistant Vice Chief of Staff LTG W. E. DePuy, Deputy Under Secretary of Defense for Operations Research Dr. Wilbur Payne, Army Chief of Research and Development LTG William C. Gribble Jr., Special Assistant for Research Dr. K. C. Emerson in the Office of Assistant Secretary of the Army (R&D) Robert L. Johnson, and Principal Deputy General Counsel of the Army R. Kenly Webster.

Primary Army interest in the negotiations was focused on preserving intact insofar as feasible the long-established operations research expertise developed by RAC and its predecessor organization, the Operations Research Office of Johns Hopkins University.

This objective reportedly is achieved in the agreement signed by William W. Edwards, GRC vice president, and James A. Wakelin, RAC board chairman. The task group determined that the GRC best demonstrated among prospective purchasers the capability of fulfilling RAC's existing contractual commitments.

"With some possible minor exceptions where synergy might be achieved by other organizational arrangements," the GRC has retained what was RAC as a separate group.

The agreement transfers to the GRC the RAC contracts. The GRC assumes the status and longevity rights of RAC personnel "unimpaired," including accrued annual leave.

The GRC will expand its efforts for additional contracts within the realm of expertise represented by the former RAC employes. However, it is explained that "since the GRC does not, and does not intend to, produce military hardware, no conflicting interests between analytical research and military hardware production" are involved.

Upon completion of the liquidation of RAC's remaining assets, proceeds will go to the U.S. Treasury. The GRC has assumed RAC's lease on the building at McLean and plans to accommodate some of its other operations for efficient utilization of space.

Key Personnel Changes. Former RAC President Frank A. Parker Jr. is now one of GRC's corporate vice presidents. A former Assistant Director of Defense for Research and Engineering, he headed the RAC since it was formed until the sale to GRC.

Dr. Hugh Cole, a 20-year veteran of the RAC and the Operations Research Office, is a GRC vice president and director of the new Operations Analysis Division, which has absorbed about 150 of the 290 former employes of RAC. This division is continuing RAC's existing defense contracts.

Dr. Edwin C. Hutchinson, formerly RAC vice president for economic, political and strategic studies, is the senior vice president of the American Technical Assistance Corp. ATAC absorbed about 25 RAC employes into a well-established GRC subsidiary formed to perform non-defense operations research.

William Beckert, a vice president and treasurer of RAC since its inception, is now a GRC vice president and director of the GRC Support Center-East, which has absorbed the RAC administrative staff.

ARMY DEPUTY CHIEF OF R&D MG George Sammet Jr. congratulates Alvin D. Bedrosian, chief of the Scientific Liaison Office, Greater Boston Area, after presenting him with the Army Decoration for Meritorious Civilian Service. Bedrosian, an Army civil service career employe since 1941—in his present capacity since 1954—was cited for "extraordinary dedication of purpose, mature wisdom and astute judgment" in dealing with laboratories of Massachusetts Institute of Technology, Harvard and other universities, as well as other U.S. Government agencies and industry in R&D matters.

QUOTE: "It is they (men of science) who hold the secret of the mysterious property of the mind by which error ministers to truth, and truth slowly but irrevocably prevails. Theirs is the logic of discovery, the demonstration of the advance of knowledge and the development of ideas, which, as the earthly wants and the passions of men remain unchanged, are the charter of progress, and the vital spark in history."

Lord Acton
Cambridge, England
June 11, 1895

MAST

Vietnam Med Evac Methods Saving Lives on Highways

Rapid and highly precise procedures developed by U.S. military medical evacuation teams to save lives of thousands of combat casualties in Vietnam have been used to save more than 200 lives in U.S. highway accidents since 1970.

Project MAST (Military Assistance to Safety and Traffic) was initiated in five states and has proved so successful that it is expected to receive Congressional approval for expansion.

Secretary of Defense Melvin Laird suggested in 1969, following one of his inspection trips to Vietnam, what has since become a joint venture of the Departments of Defense (DoD), Health, Education and Welfare (DHEW), Transportation (DOT), Justice, Interior, and the Office of Emergency Preparedness—in cooperation with state and local agencies.

Initiated on a trial basis and functioning as an adjunct to the existing local Emergency Medical Service (EMS) system, Project MAST provides helicopter evacuation to adequate medical treatment facilities. Time saved reduces the more than 55,000 deaths currently occurring annually as a result of highway accidents in the United States.

Inter-hospital transfer of critically injured patients to receive specialized treatment is incorporated with transportation of medical specialists and equipment to the emergency scene in MAST procedures.

Project MAST was introduced and has continued to operate from the following sites: Fort Carson, Colo.; Fort Lewis, Wash.; Fort Sam Houston, Tex.; Luke Air Force Base, Ariz.; and Mountain Home AFB, Idaho.

Aircraft utilized have been limited in their operations to distances of 80 to 100 miles from the respective sites, based on their fuel capacity. As of early September 1972, more than 1,300 missions had been flown, providing assistance to 1,619 patients.

RESPONDING to a civilian medical emergency, a U.S. Army helicopter waits with blades turning as a 21-year-old woman who stepped into a snow hole at the Glacier Basin region in Washington is placed on a stretcher. On the scene and during the flight to Everett General Hospital, Army medics treated patient.

MEDICAL CORPSMEN rush to MAST helicopter for emergency.

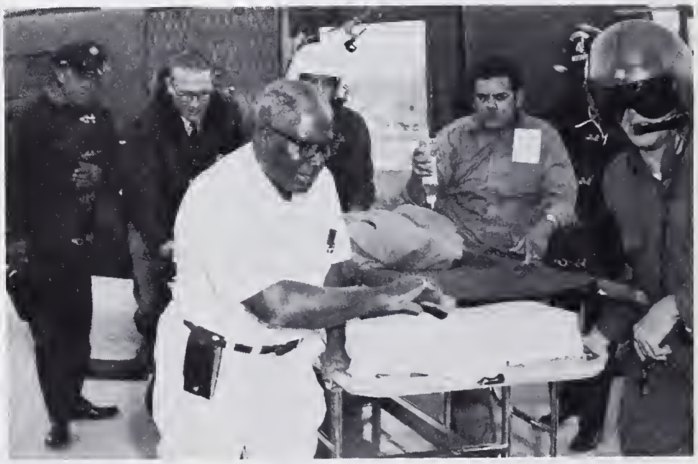
Personnel and equipment from active duty Army Aeromedical and Air Force Aerospace Rescue and Recovery units are involved. They work in cooperation with local health care and law enforcement officials.

By 1968, accidental injury in the United States had become the leading cause of death in the first half of the life span of Americans. In 1965, 52 million accidental injuries resulted in 107,000 deaths, permanently disabled 400,000 and temporarily disabled more than 10 million persons. The estimated cost of these injuries and deaths reached approximately $18 billion.

Statistics show that of the deaths in this period, 49,000 resulted from motor vehicle accidents, comprising the leading cause of death in the 1- to 37-year age group and the fourth leading cause of death among all age groups below 75 years. That the problems are not being alleviated effectively by safety campaigns is evidenced by 1968 statistics showing approximately 55,000 deaths from automobile accidents—an increase of 12 percent over 1965.

Recently enacted safety-oriented legislation has demonstrated that accidental injury and death have become recognized problems of national significance. Major interests have also developed in emergency medical care, particularly with respect to the care of victims of traumatic injury.

One aspect of emergency medical care that has begun to receive limited attention is community ambulance and rescue services. Of the motor vehicle deaths, 70 per-



MILITARY AND CIVILIAN representatives work together in MAST, as shown in this photo of patient enroute to hospital.

cent occur in rural areas and in communities with a population of less than 2,500.

In most accident situations, the greatest danger to an injured individual is shock, loss of blood, or both. The delays between the time of injury and time of receiving first aid or specific medical treatment often are critical to survival.

Recognizing the need for responsive and fast-moving rescue services, capable of delivering immediate supportive care during transport, the U.S. Army developed combat-support medical evacuation techniques in Vietnam that resulted in a remarkable reduction in deaths from wounds.

As shown in Table 1, this reduction fell from 14.9 percent in the Mexican War to 1 percent in Vietnam.

TABLE 1
Percentage of U.S. Wounded,* Dying of Wounds

War	Years	Wounded	Case fatality rate (percent)	Average time to definitive surgery (hours)
Mexican	1846–48	3,400	14.9%	Unknown
Civil War (North)	1861–65	318,200	14.1	Unknown
Spanish American	1898	1,600	6.7	Unknown
World War I (no gas)	1917–18	153,000	8.1	12–18
World War II	1941–45	598,500	4.5	6–12
Korea	1950–52	–	2.5	2–4
Vietnam	1965	–	1.0	1.5–2

*KIA categories excluded.

Following a visit to the combat area in 1969, Secretary of Defense Laird proposed formation of an Interagency Planning Group—with representation from the six federal agencies that have since been involved in MAST—to develop the use of military resources in response to civilian medical emergencies.

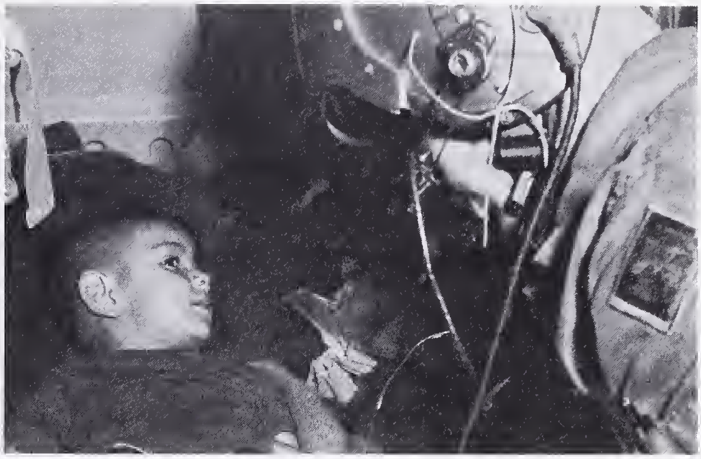
Following concurrence by the Secretary of Transportation, and after a number of meetings of an Interagency Study Group, it was decided to develop MAST in the following manner: Phase 1—design of the project and site selection; Phase 2—operations; Phase 3—evaluation; Phase 4—report and recommendations.

DOT, DHEW and DoD were asked to provide a full-time working member each to implement the basic program as the MAST administrative staff.

Site selection was based on the existence of a military capability, a State-government expression of interest in having the military involvement, a rural environment contiguous to adequate medical activity, and different climate and terrain conditions.

The MAST concept was then presented to the community's medical, public safety, and political leadership in meetings organized by DHEW affiliates. An offer was made to make MAST resources available, if desired, on the basis of a simple project proposal to be prepared and submitted by the civilian and military representatives of the geographical area.

The idea was received enthusiastically at all sites. After approval by the Interagency Study Group, MAST operations were authorized. They began July 15, 1970 in San Antonio, Tex.; Aug. 6, 1970, in Colorado Springs, Colo. and West Central Washington; and Sept. 1, 1970, in Phoenix, Ariz., and Boise, Idaho.



TRUSTING YOUNG PATIENT is reassured by MAST medical corpsman as a Medevac helicopter takes the boy to a hospital.

At each site, the program was developed by the civilian community working with the military project officer. General requirements were that the helicopters would augment or supplement the local EMS system, not replace any existing elements of it.

Stipulated also was that the operation would not be directed into downtown or metropolitan areas where ground ambulance services in general would be more responsive. Military operations, it was agreed, should avoid any competition with operators of air or ground ambulance services.

Requests for the helicopter assistance are based upon judgment by responsible medical or public safety officials at the scene of the emergency. The patient's medical condition must be serious or life-threatening, and require expeditious transport to a medical facility capable of providing the necessary treatment.

During the early pilot project phase of MAST operations, from July 15 through Dec. 31, 1970, 182 missions were flown by helicopters from all sites. Fort Sam Houston experienced the highest rate of requests for MAST missions—more than one a day.

About 20 percent of the missions were concerned with direct pick-ups at the emergency site. The remainder were primarily inter-hospital transfers of patients in critical condition from smaller, rural hospitals to one of the more advanced medical facilities within the San Antonio area.

A report prepared recently for the Director of Military Support, Office of the Army Chief of Staff, described widespread publicity about MAST. Findings indicated that the public-at-large views the concept with a favorable attitude.

The report concludes that the MAST program has proved very successful—that civil, military and police officials involved with MAST consider it would be extremely difficult to cancel the program, now or in the future.

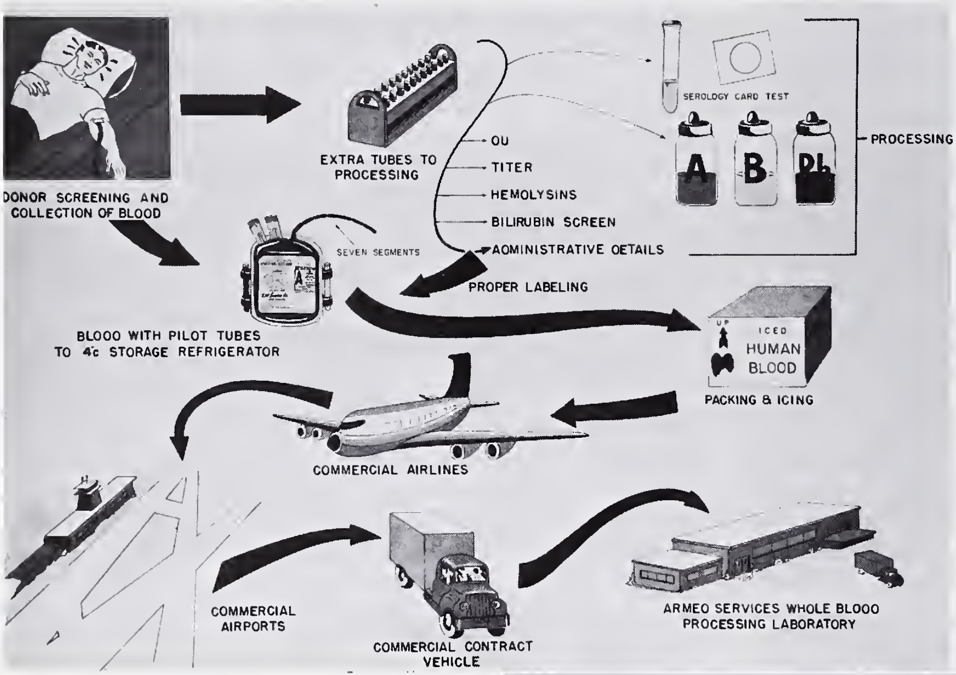
Secretary Laird, in an Aug. 22, 1971 address to the Sacramento (Calif.) Chamber of Commerce, cited Project MAST as an outstanding example of how "We have expanded our long-standing policy of transferring technical knowledge gained through Defense research and operations to the civilian sector."

Military Blood Program Office

Advances Life-Saving Procedures Through Blood Supply to Combat Zone

Preservation of life in the battle casualty is frequently dependent on a critical factor for which there is no proven substitute—blood!

The most important advance in life-saving procedures in recent years has been the rapid, large-scale use of blood and plasma replacement. Maintenance of blood volume and of red cell capacity to carry oxygen to the brain and other vital tissues allows time for surgeons to perform life-saving operations.


DONOR SCREENING AND COLLECTION OF BLOOD
EXTRA TUBES TO PROCESSING
SEROLOGY CARD TEST
OU
TITER
HEMOLYSINS
BILIRUBIN SCREEN
AOMINISTRATIVE OETAILS
A
B
DL
PROCESSING
SEVEN SEGMENTS
PROPER LABELING
BLOOO WITH PILOT TUBES TO 4°c STORAGE REFRIGERATOR
UP
ICED HUMAN BLOOD
PACKING & ICING
COMMERCIAL AIRLINES
COMMERCIAL AIRPORTS
COMMERCIAL CONTRACT VEHICLE
ARMEO SERVICES WHOLE BLOOO PROCESSING LABORATORY

But whole blood is perishable and cannot be synthesized. To date, plasma expanders have proven only partially satisfactory and cannot be used as a complete substitute to carry out the blood's functions.

Immunological factors prevent use of animal blood in humans. Human blood is divided into four major groups which are matched to the patient's blood before use.

The usually accepted effective storage life of whole blood from the time of collection is 21 days. After that time the oxygen-carrying capacity of blood is decreased and breakdown products may put a severe strain on the patient's kidneys.

Although civilian agencies cooperate with the Department of Defense in the day-to-day supply of blood, the tri-service Military Blood Program Office (MBPO) was established in the Forrestal Building in Washington, D.C., to collect, process and distribute blood in emergencies.

LTC (Dr.) Janice A. Mendelson, MC, recently was assigned to the Army Surgeon General's Office as director of the MBPO. Deputy directors are COL Hal G. Etter, representing the Department of the Air Force, and CPT Leon P. Eisman, the Navy representative. Each member has direct access to his Surgeon General in performing the functions of the MBPO.

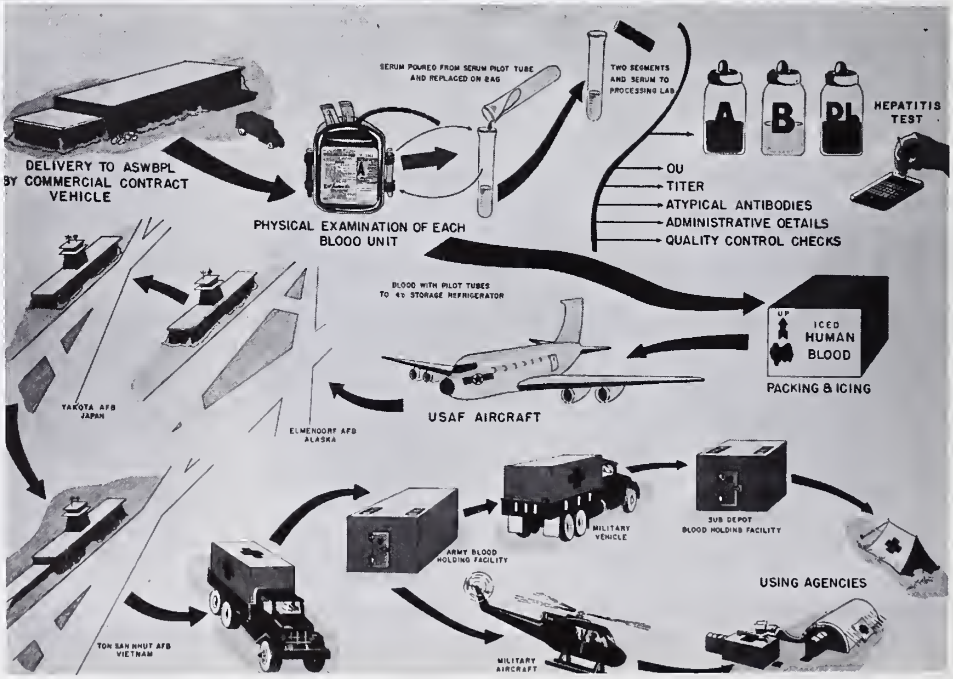
Functions include coordinating research and development programs devoted to progress and improvement in the areas of blood, blood derivatives, plasma volume expanders, and related techniques, facilities and material.

Tri-service research in blood, red cell handling and storage are being approached in three ways: Army—refrigerated, non-frozen whole blood storage; Air Force—storage of dehydrated blood or blood components; Navy—frozen storage of blood or blood components.

Continuing research is being conducted to advance the state-of-the-art in freezing and storing red blood cells "indefinitely," to maintain a supply of blood at all times.

Recent experiments have proved that the freezing process solves three major problems in storing blood. First, it provides blood that is relatively free of hepatitis, a liver disease that can be transmitted in blood during transfusions.

Secondly, it can provide a continuing supply of rare blood types. Finally, the freezing and thawing process reduces the number of stray


DELIVERY TO ASWBPL BY COMMERCIAL CONTRACT VEHICLE
SERUM POUREO FROM SERUM PILOT TUBE AND REPLACED ON BAG
TWO SEGMENTS AND SERUM TO PROCESSING LAB
A
B
DL
HEPATITIS TEST
PHYSICAL EXAMINATION OF EACH BLOOO UNIT
OU
TITER
ATYPICAL ANTIBODIES
ADMINISTRATIVE OETAILS
QUALITY CONTROL CHECKS
BLOOD WITH PILOT TUBES TO 4°c STORAGE REFRIGERATOR
UP
ICED HUMAN BLOOD
PACKING & ICING
USAF AIRCRAFT
YAKOTA AFB JAPAN
ELMENDORF AFB ALASKA
TON SAN NHUT AFB VIETNAM
ARMY BLOOD HOLDING FACILITY
MILITARY VEHICLE
SUB DEPOT BLOOD HOLDING FACILITY
USING AGENCIES
MILITARY AIRCRAFT

white blood cells. The white blood cells contain the body's defense against foreign substances, but could set up serious reactions in patients who receive frequent transfusions.

Freezing of blood, however, does not solve the major problem of the military services in carrying out the mission of supplying whole blood ready for immediate use and more adaptable to emergency field use.

The MBPO has established procedures for collecting, processing and distributing whole blood to field or other medical facilities in a minimum amount of time. Blood is collected from military personnel and their dependents, or Department of Defense employes, at any authorized Army, Navy or Air Force blood donor center throughout the United States, in accordance with quotas established by the MBPO.

Requirements of military medical treatment facilities throughout the Continental United States can be met immediately through rapid communication and procedures established by the MBPO.

In shipment of blood to Vietnam, the whole blood is typed and checked at the donor centers. It is then packed, iced and transported via commercial airlines or commercial contract vehicles to the Armed Services Whole Blood Processing Laboratory (ASWBPL), McGuire Air Force Base, N.J.

The ASWBPL has been operational since June 1966, in response to the whole blood demand created by the war in Vietnam. Prior to that time, almost all whole blood needed for treatment of Vietnam war casualties came from the U.S. Army's 406th Medical Laboratory, Tokyo, which collected blood from servicemen throughout the Pacific Theater.

At the ASWBPL, the blood is rechecked for proper grouping and Rh factor, given a hepatitis test and other quality control measures, and repacked in ice. Then it is taken directly to a U.S. Air Force aircraft for an 8-hour flight to Elmendorf Air Force Base in Alaska.

At Elmendorf, the blood is checked for sufficient ice before it is flown to Yokota Air Force Base in Japan. There the shipment is checked again for adequate ice, and arrangements are made for a flight to Ton Sat Nhut AFB, Vietnam.

The blood is transported in Vietnam by military vehicle or aircraft to a subdepot holding facility or directly to the medical unit where it is needed. The complete cycle of getting the blood from the donor to the battle casualty in Vietnam sometimes uses as little as three days of the 21-day shelf-life of blood.

Research is now being directed to prolonging the shelf-life of blood. This goal that has been demonstrated to be feasible by adding two naturally occurring substances to the mixture of glucose and salts added to nourish the living cells.

Safety of these additives and the oxygen capacity of the aged red cells is being evaluated. It is believed that, within two or three years, data will be available on toxicity of additives and other factors necessary to obtain Food and Drug Administration approval for human use.

YOUR ARMY SCIENTIST

by Rube Weiss

LTC JANICE MENDELSON, MC

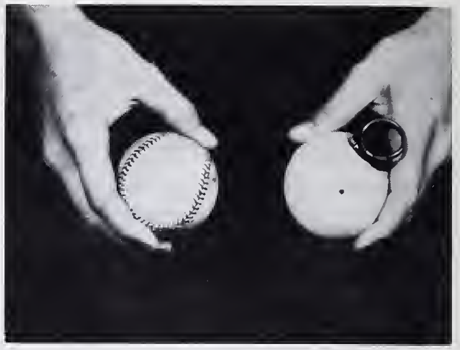
ARMY'S *ONLY* WOMAN SURGEON...

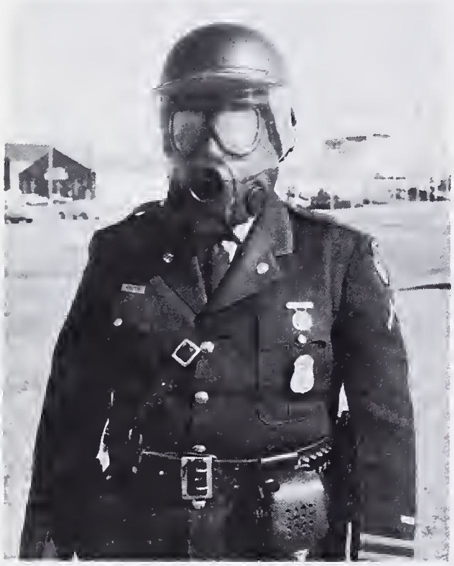
OF ABOUT 30 WOMEN DOCTORS IN THE ARMY... LTC JANICE MENDELSON IS THE ONLY SURGEON! ...TEACHER, RESEARCHER, AUTHOR *OF* OVER 20 SCIENTIFIC PAPERS, SHE DEVELOPED A NEW METHOD OF PREVENTING DEATH FROM BURN OR WOUND INFECTION... WON A COVETED BIENNIAL ARMY SCIENCE CONFERENCE AWARD!

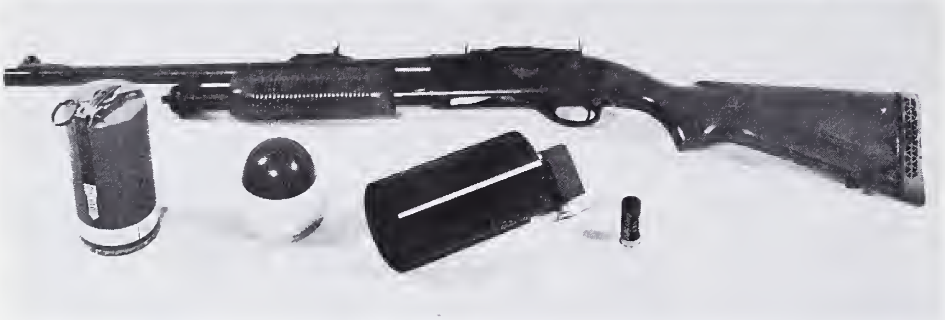
DR. MENDELSON WAS A SURGICAL ADVISOR IN VIETNAM... *SET* UP A MODEL BURN TREATMENT CENTER IN VIETNAMESE MILITARY HOSPITAL... RECEIVED VIETNAMESE *AND* U.S. MILITARY AWARDS INCLUDING THE BRONZE STAR... *TAUGHT* AND DEVELOPED MODERN METHODS FOR TREATMENT OF THE INJURED... *NOW* DIRECTOR OF THE TRI-SERVICE MILITARY BLOOD PROGRAM AGENCY SUPPLYING BLOOD WHEREVER NEEDED!

Riot Control Technology

Army Land Warfare Laboratory Serving Needs Of Law Enforcement Assistance Administration







Military technology used in civil disturbances and riot control is now being applied to assist the Law Enforcement Assistance Administration, an agency of the U.S. Department of Justice, Washington, D.C.

Developing and evaluating less-than-lethal and other devices used by the Army for this purpose is a function of the Land Warfare Laboratory (LWL), Aberdeen (Md.) Proving Ground. In response to an LEAA request to include other competitive less-than-lethal mechanisms, the LWL recently entered into an interagency agreement with the LEAA.

Included in the agreement are objectives, responsibilities, reporting, funding, technical approaches and time frames, with identification of LWL and LEAA project leaders.

Among the first tasks given to LWL was evaluation of an *All-purpose Communication/Protective Helmet* that would be effective under a variety of conditions.

After conducting ballistic tests on a number of helmets to determine their protective characteristics and evaluating their radio electronics for acceptability to law enforcement personnel, LWL recently completed the physical test portion of this project.

Now in the hands of law enforcement representatives for further user test and evaluation, the complete system consists of a protective helmet, face shield, neck protector, and radio components in an integrated assembly.

As other specific needs are identified

Some of the riot-control devices developed by the LWL are shown. Top: (l. to r.) are the All-purpose Communication/Protective helmet, worn by a police officer in a test; Short-range Simultaneous Communication System, with a soldier wearing the multicom on his pocket; Personnel Marker Grenade, comparable to a baseball in size; Center: **Liquid Projector (water gun) with components, including launcher, styrofoam sabot and plastic water sphere;** Bottom: **Improved Retransmission Device, with telephone assembly; and the hand-held Transfrisker, used in conjunction with a walk-through station to pinpoint contraband.**

by LEAA, discussions with LWL technical personnel will produce ideas and concepts which can best solve the specific problem.

The LWL has been actively involved in a number of Army projects calling for evaluation and production of less-than-lethal weapons and other devices useful in riot control. One basic problem has been in the area of constraints, which must be enmeshed with the area of incapacitation.

Whereas conventional weapons can be evaluated without worry of constraints on the maximum extent of injury they will inflict, less-than-lethal weapons require constraints which must be stated as part of their development. At present, such constraints are not standardized.

Consequently, the LWL has specified the following objectives in carrying out the work described in this article:

- Construct scenarios depicting situations likely to confront military control forces and/or police during civil disturbances.
- Given appropriate scenario definitions, establish methodology for determining standardized less-than-lethal weapon effectiveness and safety characteristics.
- Develop and/or modify existing weapon effectiveness models to give a 2-parameter measure, one measuring effect and the other safety, of the value of candidate less-than-lethal weapons systems (models to be developed for both point and area targets).
- Establish damage mechanisms which will be utilized in the evaluation of such systems.
- Develop a data bank by quantifying damage mechanism outputs and estimating probabilities of less-than-lethal incapacitation and undesirable damage.

Adhering to these objectives and related guidelines, LWL is, and has been, working on a number of significant projects. Among them are:

Rapidly Emplaced Barriers. Still in the conceptual stage, this task envisions development of a portable, rapidly emplaced, chemically treated barrier which may be inflatable and/or modular in construction.

The barriers will be used to deny access to areas or to channel movement of people. A means of anchoring the reusable barriers in position will be provided.

Chemical deterrent or identification agents can be used with the barriers. Control personnel will normally be used to man the barriers at check points, but the number of personnel required will be small.

Specific characteristics of the barriers cannot be delineated at this time. As proposed the barriers are expected to be 8 to 10 feet high, constructed in modular form, and have a strong, slippery finish. An inner bottom liner filled with water will give the barrier weight and location stability.

In collapsed configuration, the module would be sufficiently light to be handled easily by one man. Inflation could be accomplished by using air tanks, compressors, hot gas generators, or other apparatus. It is proposed that the inflating medium would also be the vehicle to put whatever chemical is selected into the barrier.

Contract negotiations for development of this item are under way.

Less Lethal Ammunition for Small Arms. To fulfill the need for a small arms round with low lethality, LWL is testing selected available hardware and development of new items. Five new concept items are under investigation.

A round or weapon system that can guarantee no fatalities under all conditions does not now exist. However, a number of devices are coming on the market which show low lethality potential over certain ranges.

LWL's feasibility study includes a survey of existing systems and testing of those that appear most promising. In addition, new concepts of items bearing promise are being fabricated and tested.

The Department of the Army has not established criteria for less than- or nonlethal ammunition. Because of the number of available items and lack of specific lethality criteria, the LWL has determined that it is infeasible to develop realistic military characteristics at this time. The laboratory plans, however, to design, fabricate and test more prototypes in the coming months.

Portable Pumping System. This is a portable water dispensing system mounted in the cargo bed of a standard military 2½-ton truck. The system will be operable by one man while the vehicle is in motion or standing. Normally it has a crew of two in addition to the vehicle driver.

Water force will be adjustable depending on the distance of target personnel from the vehicle, to reduce the probability of lethality. It is to be capable of preventing a 200-pound man from approaching closer than 75 feet.

The system is expected to be an effective means of riot control and will assist Military Police and National Guard units in holding back a mob without causing permanent injuries. Currently under development, it is scheduled for in-house laboratory testing by the end of the year.

Pulsed Jet Water Dispenser. Another effective but nonlethal method of crowd control, a water dispenser system capable of rapid repetitive pulses, is being developed. The water jet is intended to deter a crowd at 90 to 100 feet at a pulse rate of 2 shots per second, with a maximum range of 150 feet.

Intermittent pulses will permit operation at a higher power level with less parasitic weight and volume than a continuous pumping system, and will conserve water. Pulsing is to be pressurized by a propellant cartridge, with a semiautomatic feed and ejection system that will permit one or two bursts a second to deter massed rioters.

The LWL has completed feasibility tests and is developing a rapid-fire system expected to be ready for user evaluation this fall.

Liquid Projector. LWL researchers have determined the feasibility of projecting water-filled burst-on-impact spheres as a humane method of crowd control.

Designed to rupture on impact at a predetermined pressure, the spheres will impart a controlled and evenly distributed force. They will be launched by an attachment to a standard military 12-gauge shotgun. The launcher is a commercial item developed for riot control agent grenades.

The 3-inch spheres rupture in orange peel fashion to control the injury-producing effect. Muzzle velocity is 160 feet per second and maximum range is 500 feet. A styrofoam sabot prevents rupture of the sphere during launching. Lethality tests at Edgewood (Md.) Arsenal are under the sponsorship of the U.S. Army Small Arms Systems Agency.

Personnel Marker Grenade. A plastic grenade, about the size of a baseball, permits control authorities to mark, for later identification, riot leaders and agitators. The hand-thrown, nonlethal, nontoxic, nonirritating, nonexplosive device covers a small group of individuals with an easily recognizable dye. One hundred prototypes were assessed in demonstrations last year.

Detection of Concealed Metal Objects. To provide a method of conducting "hands-off" search of individuals for concealed metallic items, LWL has been evaluating two all-metal walk-through stations.

Concurrently, 12 AN/PSS-12 Transfriskers and 5 ferrous metal detector walk-through stations have been evaluated in Vietnam. Most of the devices can be adjusted to pick up items as small as keys or coins. The problem, then, is to select an operating sensitivity and technique that does not cause unnecessary alarms from metal items normally carried by a person.

The Transfrisker is used in conjunction with a walk-through station to pinpoint the location of contraband on a person rendered suspect by the walk-through alarm. Final reports on these items are forthcoming.

Short Range Simultaneous Communi-

(Continued on page 14)

LWL Serving Law Enforcement Agency Needs

(Continued from page 13)

cation System. LWL scientists also are considering military application of a radio modulation technique that permits simultaneous transmission by two or more radios on one frequency without interference. The conventional push-to-talk switch is eliminated, so the channel cannot be tied up by someone holding the transmit switch on. Garbled transmission normally caused when a second transmitter is turned on is thus avoided.

Operation of the system is based on an FM pulse modulation controlled not only by voice input but also by feedback from the receiver. Pulses of two or more transmitters, while operating simultaneously, phase lock and do not interfere, permitting the equipment to be used as a relay system with no modification or additional units.

Four multicom radios are undergoing tests at LWL, and a feasibility study on increasing their range is being carried out under contract.

Improved Retransmission Device. Evaluation of the 4-pound retransmission unit is under way at the Infantry Center, Fort Benning, Ga., and by MASSTER (Modern Army Selected Systems Test, Evaluation and Review) for the Army. The Naval Electronics Laboratory, San Diego, Calif., is evaluating the unit for the Marine Corps.

The purpose of this device is to provide remote use of command radios by enabling the commander to be separated from the radio and operator as a means of eliminating a distinctive target. The control unit accepts the AN/PRT-4A signals and, in turn, actuates the PRC-77, VRC-12 or GRA-39. Signals received over the net are retransmitted to the commander's AN/PRR-9 receiver. An interlock in the retransmission unit prevents simultaneous operation of the voice channels.

The retransmission unit is easily attached or removed, does not interfere with normal use of the tactical components, and requires no modification to the existing PRC-77, VRC-12 or GRA-39. Communication between the radio operator and the commander is not affected; the unit is also compatible for use with the SB-22 switchboard.

A few unusual concepts have also been studied by LWL as possibilities for riot-control devices. One envisioned a gun that could shoot itching or sneezing powder at a mob leader. Another was an acoustic telescope hooked up to a bull horn so the agitator's voice would be fed back to him out of phase and cause stammering.

For isolating mob members, one proposal considered flickering lights at a certain frequency to bring the pupillary reflex into play—causing discomfort and dazzle, with the eyes feeling gritty.

Other concepts, techniques, and devices have been proposed, discussed, and developed under the aegis of LWL, such as a crowd-enveloping foam spray and slippery surface sprays ("instant banana skin"). Many have become effective implements in riot and mob control action. Other concepts are still "on the drawing board."

Working with LEAA under the recent agreement, LWL researchers expect to come up with other more effective methods of solving many of the problems of control of civil disturbances and riots.

Key Personnel Involved in USARO Realignment

Realignment of the U.S. Army Research Office within the Directorate of Army Research, Office of the Chief of R&D in the Pentagon, is reported on pages 5 and 6. Biographical information on top personnel involved follows:

BG Charles D. Daniel Jr. has served as Director of Army Research since Apr. 3, 1972, following his return from Korea as deputy CG of the Support Command. He was assigned to the Office of the Chief of Research and Development (1968–71), first as chief of the Nuclear, Chemical and Biological Division and then as director, Missiles and Space. His more complete biography appeared in the March-April 1972 edition, page 48.

COL James W. Barnett, who succeeded COL Norman L. Rosen as Deputy Director of Army Research upon his retirement Sept. 30, is like his predecessor a graduate of the United States Military Academy with a BS degree in military engineering and an MS from Massachusetts Institute of Technology.

COL Barnett obtained his MS in nuclear engineering and COL Rosen in civil engineering. Both have directed major engineering projects in the U.S. and overseas. COL Barnett's record shows that he managed construction of development, production and test facilities for Saturn V launch vehicles while on loan to NASA.

Other highlights of his engineering career have included direction of construction of the nuclear power plant at Camp Century, Greenland, for the Army's experimental "City Under the Ice," and also managed construction of expanded facilities for the United States Military Academy.

During 1969–72, he headed the U.S. Army Engineer District, New York, following a 1968–69 tour with HQ Military Assistance Command Vietnam. This was preceded by two years as CO of the 7th Engineer Battalion, 5th Infantry Division (Mechanized) and CO, 331st Engineer Group, Fort Carson, Colo.

COL Barnett is a 1961 graduate of the Command and General Staff College and the Army War College in 1966. His military honors include the Legion of Merit with Oak Leaf Cluster and the Army Commendation Medal with 2 OLCs.

Dr. Ivan R. Hershner's experience for his duties as successor to Dr. Richard A. Weiss includes service as one of the "founding fathers" of the Army Research Office. He became chief of the Physical Sciences Division in 1959 and headed the U.S. Army Materiel Command planning staff group in 1962 and filled in as scientific director for Dr. Weiss while he attended the National War College in 1963–64, and became chief of the Physical Sciences Division in 1959.

Dr. Hershner also was one of the chief planners for the establishment of the Mathematics Research Center, U.S. Army, at the University of Wisconsin. In 1960 he began more than a decade of service as chairman of the Army Mathematics Steering Committee, which provided guidance to the MRC.

Dr. Hershner earned BS and MS degrees in mathematics and physics at the University of Nebraska and a second master's and doctorate in mathematics at Harvard University. He was an instructor at the University of Chicago, assistant professor at the University of North Carolina, and professor and chairman of the Department of Mathematics at the University of Vermont prior to joining the OCRD, HQ DA staff in 1956. In 1969 he was chairman of The Army Research Council.

COL Richard Rooth's biography appeared in the 1971 April-June edition on page 42, *LTC Theodore Gregory's* in the July 1972 edition on page 45, and *LTC Alvin Meredith's* in the March-April 1970 edition on page 21.

LTG Gribble Presents Rosen With Second Legion of Merit

Army Chief of R&D LTG William C. Gribble Jr. presented a second award of the Legion of Merit to COL Norman R. Rosen when he retired recently as Assistant Director of Army Research and CO of the U.S. Army Research Office.

The award recognized COL Rosen for numerous outstanding contributions, including his lead role in the realignment of the U.S. Army Research Office planned for the near future—which also made him the target of numerous humorous gifts at farewell parties. During two tours of duty with OCRD (1959–63 and 1970–72), he was a key officer in many major projects.

In addition to playing a lead role in the move of the Army Research Office to the Highland Building in Arlington in May 1962, as project officer, he also was detailed as military assistant to the Deputy Director of Defense Research and Engineering (Administration and Management) for five months.

Other special assignments included staff assistant to the Army member, Coordinating Committee on Science, and research director, Autoprobe Task No. 2. He was assigned to the Office of the Assistant Chief of Staff for Force Development, HQ DA (1964–65) and to HQ U.S. Army Element, Supreme Headquarters Allied Powers Europe (SHAPE), 1966–69.

COL Rosen retired from the Army to accept an engineer construction coordinator position with Bechtel Corp. on the Metropolitan Rapid Transit System for the Greater Washington area.

Army Engineers Report on Alaskan Pipeline Study

Operational information related to the potential ecological impact of the proposed Trans-Alaska Pipeline to transport petroleum from Alaska's huge oil resources on the North Slope is contained in a recently published Army-sponsored study report.

"Preliminary Investigations of Petroleum Spillage, Haines-Fairbanks Military Pipeline, Alaska" is the title of the report. Coauthors are Warren E. Rickard, botanist, and 1LT Frederick Deneke, forester, both assigned to the Earth Sciences Branch, Research Division, U.S. Army Cold Regions Research and Engineering Laboratory (CRREL), Hanover, N.H.

CRREL is an agency of the U.S. Army Corps of Engineers and the study was conducted under sponsorship of the Life Sciences Division, Army Research Office, Office of the Chief of Research and Development, HQ DA.

"The findings in this report," the disclaimer states, "are not to be construed as an official Department of the Army position unless so designated by other authorized documents."

Construction of the Haines-Fairbanks Military Pipeline was completed in 1955, when the Army assumed responsibility for its operation and supervision.

The 626-mile 8-inch line traverses Canada and Alaska to its termination at Fairbanks. It serves to transport diesel oil, aircraft turbine and jet engine fuel, automotive combat gasoline, and aviation gasoline.

Forty recorded spills caused by breaks in the line, or by cuts to conduct deicing operations, provided the Corps of Engineers an opportunity to study effects of petroleum products spillage on vegetation and microbial activity, as well as determine the relative amounts of spill remaining in the soil.

Only 12 of the ruptures in the pipeline were not attributable to the deicing operations, and only five of these were caused by corrosion of the pipe. The others were due to accidents or bullet holes.

Among its findings, the study revealed that most areas affected by the spills had little or no vegetation regrowth even after 15 years, although new vegetation was growing within and adjacent to drainage pathways. Growing conditions there had been improved by leaching of petroleum from the soil by runoff water.

Effects on woody vegetation were noted by examination of cross sections through the larger trees. Growth rings showed a definite suppression in diameter increase during the years spills occurred.

An example of the findings in the report describes ecological results of a pipeline break that occurred in December 1968. A small corrosion leak in a buried portion of the pipe resulted in an estimated loss of 800 barrels of petroleum products. The pipe had to be excavated for a long distance before the high-pressure leak could be found.

Fuel soon filled the excavated trench, was subsequently pumped into a tank, and the residue was burned off numerous times throughout the winter. Some large cottonwoods and alders in a nearby depression were killed, apparently from the fuel.

Today, two of 10 large cottonwoods at that site have a few leaves in some upper branches. In addition, a number of new branches are growing out from the bases of the alders. But, the interior of the stand is devoid of lower canopy vegetation, while adjacent areas show luxuriant growth.

Residual effects of some kind were noted in other areas where spillage had occurred. In one place, a black spruce growing at the edge of a line cut has grown very little in 15 years. Another sample of a hemlock near a 1968 pipeline rupture has a very narrow growth ring with no "latewood" growth occurring during that year.

A third sample from near Dezadeash Lake shows suppressed growth following the spill. This sample also shows an increase in the number of resin cells, a characteristic often found in trees subjected to fire.

Analysis for petroleum content in the spills has been delayed as standard Arctic diesel and aviation fuel samples had not arrived at the Cold Regions Research and Engineering Laboratory when results of the study were being compiled for publication.

Determination of respiration rates had begun but will take some time to complete because of the number of samples involved. They are being run on a Gilson respirometer using standard techniques.

The fact that vegetation growth has been depressed over the 15-year period seemed surprising to the analysts. Their first thoughts on the matter lead to the conclusion that all of the active petroleum products should be decomposed or leached from the soil by this time. But, they reported, this has not happened.

Fuel additives and the degree of solubility in water are factors which may have some influence on the presence of petroleum in the soil. The study indicated that certain petroleum, such as JP-4 fuel, is not soluble in water. Because of the lack of precipitation in the subarctic, leaching of chemicals from the soil is very slow.

This also could substantiate the fact that some vegetation has been able to grow in drainage basins within the fuel spills where larger volumes of runoff occur.

The dispatching of products through the line is controlled from the Dispatch Division at Fort Richardson, Alaska. Through an elaborate telecommunications system, all phases—including pumping pressure at individual stations—are monitored on a large display panel.

Any combination of fuels can be transported at one time by maintaining a minimum turbulent flow rate of 450 barrels per hour. The line's maximum flow is 27,500 barrels daily if all pumping stations are utilized.

AMMRC Acquires Computerized Impact Test System

Dynamic plane-strain fracture toughness tests of materials over a temperature range of more than 700 degrees—from 440° F. to minus 320° F.—can be made with the U.S. Army Materials and Mechanics Research Center's new computerized Charpy impact system.

Acquired recently, the system was developed under the technical supervision of Thomas S. De Sisto, a general engineer in AMMRC's Metals Division at Watertown, Mass., by contract with International Harvester Co.

Brittle ceramic materials such as alumina and hot-pressed boron carbide, and structural metals such as aluminum, steel and titanium alloys, can be tested in thickness ranging from 0.100 to 1.182 inches.

System components include a 240-foot-pound capacity Sonntag impact tester with a strain-gauged tup, an analog-to-digital converter, a PDP-8 computer and a teletypewriter. A 2,200-foot-pound Mouton impact tester with a strain-gauged tup can be adapted to the system.

When the tup fractures the specimen, an analog strain signal enters the oscilloscope, is amplified and displayed on a cathode ray tube (CRT). The signal then enters the converter, where it is digitized each 1.45 microseconds. The digitized data are received and stored in the computer.

When the computer senses approximately zero volts, the data collection cycle is terminated and the computational cycle is initiated. The teletype printout lists pre- and post-maximum load energy, total impact energy, maximum force, time-to-fracture and K_{ID} and G_{ID} values, calculated from maximum force and crack opening displacement (COD) measurements.

A useful option is the printout of the load versus time curve from the digitized force data. This allows for a comparison of the data against the calibrated analog trace on the CRT and is less costly than taking Polaroid photos of the trace.

HumRRO Declassified as Federal Contract Center

Approval of a request by the Human Resources Research Organization (HumRRO) to be declassified as a Federal Contract Research Center (FCRC) for the Department of Defense was announced early in October.

HumRRO now conducts behavioral and social science research and provides advisory services to improve human performance for many organizations, including the U.S. Army and various U.S. Government agencies.

Established in 1951, HumRRO conducted R&D exclusively for the U.S. Army until 1967, when the contract was revised to permit HumRRO to extend its services to additional organizations. HumRRO is headquartered in Alexandria, Va., with field units in Georgia, Kentucky, Alabama, Texas and California.

Eighteen years of affiliation with the George Washington University terminated in 1969 when HumRRO requested and was granted permission to incorporate as an independent, nonprofit corporation—again with the objective of expanding the scope of its activities to serve other users.

In the early 1960s, the National Science Foundation created the category of Federal Contract Research Center to cover a disparate group of R&D organizations which had been created specifically to serve some particular need of the U.S. Government for research, development, test and/or evaluation. HumRRO became an FCRC in 1963.

NBS Linked With Army LWL in Law Enforcement Aid

Under an agreement with the Law Enforcement Assistance Administration (LEAA), U.S. Department of Justice, the National Bureau of Standards (NBS) is mounting a comprehensive research program to improve and standardize equipment for law enforcement officers.

The U.S. Army Land Warfare Laboratory has entered into a similar agreement with the LEAA to conduct research for development of technology and less-than-lethal mechanisms. (See feature article on page 12). Both the NBS and LWL agreements with the LEAA provide for equipment and devices used at all levels of law enforcement.

The NBS Law Enforcement Standards Laboratory (LESL) has started development work on protective equipment and clothing, emergency equipment, communication systems, security equipment, alarm and surveillance systems, concealed object detectors, vehicles, police weapons, and correctional institution building systems.

Already involved in the program are the NBS technical divisions for electromagnetics, analytical chemistry, applied radiation, mechanics, heat, building research, technical analysis, measurement engineering, and electronic technology, as well as the Department of Transportation's Safety System Lab.

Generally, each federal, state and local law enforcement agency operates independently in securing equipment. Since there are no nationally accepted standards, equipment specifications vary greatly from department to department, state and local levels. Sometimes the required specifications come from the salesmen for equipment that has already been selected. LESL seeks to correct this situation by performance standards research.

One example of the efforts under way is in the area of security equipment. False alarm rates from intrusion-detection systems have been reported by some cities to be as high as 97 percent.

NBS cites one objective of the new program as reduction of this rate by developing minimum performance standards for more effective quality control in manufacturing the law-enforcement equipment subsystems. Included are surveillance devices and physical deterrents, such as locks, protective cages and safes.

NBS is developing a performance standard for the "nightscope," a night-vision device originally developed by the U.S. Army Night Vision Laboratory for the Department of Defense and recently made available to law enforcement agencies.

The hand-held device intensifies light too faint for the human eye to see and displays an image similar to a high-resolution television picture. (See article on Night Vision, *Army R&D Newsmagazine,* July 1972.)

In an era marked by skyjacking and other crimes threatening public safety, this new NBS standardization program is expected to produce positive results for law enforcement use in all areas being researched.

Army Proceeding With Prototype Development Of Utility Tactical Transport Aircraft System

Conforming to the new Department of Defense prototyping concept in research and development, the Army is proceeding with development of the UTTAS (Utility Tactical Transport Aircraft System).

The first flight of prototype aircraft is expected in November 1974 under contracts recently awarded to the Vertol Division of Boeing Co. and Sikorsky Aircraft Division of United Aircraft Corp. The competitive prototyping will result in selection of one company for production of the UTTAS.

Prototype fabrication will not exceed the numbers normally required for the advanced development selection process combined with engineering development design flight testing.

Engine development will cost $56.5 million, carrying through military qualification testing and qualifying for operational use, under the R&D contract recently signed with General Electric Co.

The total contract with GE is $97.7 million, but $41.2 million is for procurement of an engine "support package." This includes engine prototypes and maintenance support during the airframe development and flying period. This same engine will be provided to both Boeing and Sikorsky for use in the competitive fly-off.

Engine development, based on a design validated by the Army in the advanced development phase, started in August 1967. More than 8,000 hours have been accumulated on the critical engine components, thus reducing considerably engine development risk.

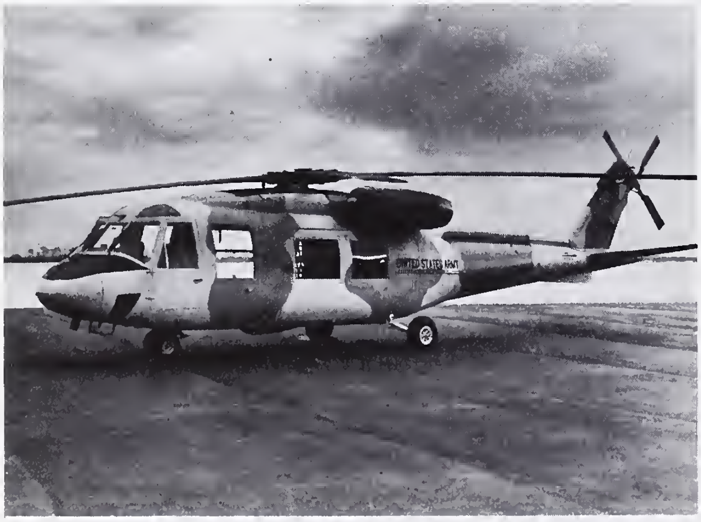
The engine design provides specifically for special helicopter requirements (vs. fixed wing) in such technical areas as "low-cycle fatigue," particle ingestion and airframe vibration.

When the Army made a detailed assessment of three engines initially proposed by industry for the UTTAS, which included one design with a twin centrifugal compressor, the one selected was considered the best over-all design with margin to spare.

A detailed study of the French SA-330 as a potential UTTAS was made prior to initiation of the current program. However, it failed to measure up to the UTTAS requirements on the basic areas of transportability, maintainability, reliability and survivability.

While the SA-330 has an investment cost of about 80 percent of that projected for the UTTAS, U.S. Army authorities say the performance is only 65 percent of that desired.

When UTTAS starts to enter the Army inventory, most of the UH-1H Huey fleet will be over 10 years old, with a significant number over 15 years old. UTTAS will replace the UH-1H in assault helicopter companies, air cavalry units and aeromedical evacuation units. However, the UH-1H will be retained in other type units well into the 1980s.



FULL-SIZE mockup of Boeing UTTAS

PROPOSED Sikorsky UTTAS Aircraft

ECOM Remote Terminal Linked to DDC Data Net

If you work for the Army Electronics Command and want to find out what has been done, is being done or is being planned in the Defense Department on any scientific subject, you can "talk" to a computer in Washington and find out in minutes.

This is because a remote on-line retrieval terminal, providing access to data banks operated by the Defense Department (DoD), began operation Sept. 13 in the Scientific and Technical Information (STINFO) Branch of the Management Information Systems Directorate.

Linked by teletypewriter directly to the main computer at the Defense Documentation Center (DDC), Cameron Station, Va., the terminal will be used to obtain scientific and technical information for scientists, engineers and managers in support of the command's research, development, testing and evaluation (RDT&E) mission.

DDC, the central research and development information center for the Department of Defense, maintains data banks of recorded information on past, present, and planned RDT&E work effort.

On-line retrieval is available from: 1) the DDC technical report data bank, comprising 750,000 reports on DoD-sponsored RDT&E effort dating back to 1950; 2) the DDC work unit data bank, comprising 60,000 (DD 1498) work unit summaries of DoD on-going RDT&E effort; 3) the DDC R&D program planning data bank, consisting of 6,000 (DD 1634) summaries of planned RDT&E effort.

The first search—a retrospective literature search—informs the scientist of work accomplished in the past in his specific field of interest; the second search reveals parallel or related on-going RDT&E effort within DoD; the third search provides technical and management information on planned RDT&E projects and tasks.

Users of the terminal will interrogate the DDC data banks by keying a query on an input/cathode ray tube display device keyboard. The initial computer response will indicate the number of citations called out by the search. If the number of citations is too large, the user may qualify his query, repeatedly if necessary, to attain the desired specificity and relevance of retrieval.

Thus the user has access to the data banks on a completely interactive basis permitting him to probe, browse, identify and retrieve information directly from the computer without intermediary assistance.

The final search results are displayed as full document citations on the cathode ray tube display; if the citations are too numerous, the user may ask that the search results be run off on the associated page printer and be sent to him.

Prior to installation of the on-line terminal, searches were obtained by mail from the DDC data banks, entailing delays of two or three weeks. If a search was unsatisfactory, resubmittal of a revised query by mail occasioned another long delay.

A significant advantage of on-line retrieval is the time saving afforded by the real-time response of the DDC computer to remote interrogation. Thus the user, in direct communication with the DDC computer, obtains search results within minutes of his query. Moreover, he is able to modify his search parameters to achieve desired retrieval.

The searches obtained on the terminal, plus the current-awareness service provided by the STINFO Branch's locally automated Selective Dissemination of Information system, result in an annual referral of 340,000 documents of potential interest to ECOM professional personnel. Approximately 32,000 of these citations are sufficiently relevant to trigger requests for full documents.

$5 Million Allotted for WSMR Improvements

Facilities at White Sands (N. Mex.) Missile Range are being improved by construction and equipment contracts totaling more than $5 million, half of which will provide the Army with one of the most modern continuous film processing plants in the country.

Improvements also include instrumentation and nuclear effects facilities and electric power distribution system changes.

The new film and magazine handling, issue and receiving facility will have a conveyor system designed for better workflow and security control. The plant will utilize the latest chemical processes of the photo industry, including new technological developments in automatic controls and pollution abatement methods.

The construction program is being accomplished in three major phases and is scheduled for completion March 1973.

Yuma PG Helps NSF Set Up Mountaintop Lab

Airlifting a mobile home converted to a laboratory from Boulder, Colo., to an 11,500-foot mountaintop 28 miles away was accomplished recently by Yuma Proving Ground (YPG), Ariz.

Responding to a request from the National Science Foundation, YPG personnel provided the airlift over roadless terrain to a point selected for research of plant growth in alpine tundra by the Institute of Alpine and Arctic Research of the University of Colorado.

Weighing 13,000 pounds (later stripped down to about 10,600) and measuring 23 × 7 × 8 feet, the converted vehicle, on loan for the project, belongs to San Diego State University. YPG's first concern was to determine which Army helicopter could pick up that much weight, fly with it and set it down at 11,500 feet. It was decided that the lift could be made with a CH54 Flying Crane.

Next, a way to suspend the vehicle had to be considered since the mobile laboratory was not designed for air transport. A brainstorming session resulted in the design of a lift assembly consisting of two I-beams per axle and a curved cup section which would cradle the wheels.

The I-beams were tied rigidly to the frame of the vehicle, with long nylon slings, two in front and two aft, attached to form the sling configuration. Spreader bars were used near the top of the slings to keep them from crushing the fiberglass shell when loaded.

The I-beam apparatus, made at YPG, had been loaded aboard a Huey helicopter and flown to Boulder. The laboratory was rigged there and lifted by a land-based crane to determine if the lift angle of five degrees nose down was correct.

Under ideal conditions, the Flying Crane is capable of lifting a maximum of 24,000 pounds at sea level. Its range, however, is rather short when fully loaded. Piloted by CWO Hollis Scott of the 291st Aviation Company, Fort Sill, Okla., the CH54 used was stripped down to lift heavier loads.

Smokebombs placed at the mountain site identified where the mobile laboratory was to be positioned. Despite surface winds as high as 60 mph, the pilot succeeded in positioning the laboratory precisely where desired for scientific research.

CERL Develops On-Site System For Safeguard Data Management

An on-site management records system (OMRS) is being developed by the Construction Engineering Laboratory (CERL), Champaign, Ill., for Safeguard Ballistic Missile Defense System facilities.

When operational, OMRS will optimize maintenance of Safeguard electrical and mechanical tactical support systems. It is designed to make effective use of manpower and the scheduling of preventive and corrective maintenance, as well as to expedite the reporting, record-keeping and information retrieval of maintenance actions.

Although OMRS is a computer-oriented system, the Corps of Engineers' Huntsville Division will initially combine manual and computer modes of operation. CERL's Electromechanical and Environmental Systems Division (EESD) has already developed the basic operating philosophy.

The method will be a modification of a previously developed computer-based retrieval system of failure and repair-time data which the EESD devised for Minuteman and Titan missile facilities.

Combining the automated data base with OMRS, it is estimated, can provide maintenance information retrieval at annual savings of $100,000. EESD personnel expect to consider applications of OMRS for other facilities such as military hospitals.

Information Systems Selected for Discussion At Fourth International COINS Symposium

"Information Systems" is the theme of the Fourth International Symposium on Computer and Information Science (COINS-72), Dec. 14–16, at Miami Beach, Fla.

Among the leading scientists, engineers, educators and administrators expected to attend will be six representatives from the Soviet Union. Previous COINS symposia have attracted 200 to 400 participants from all parts of the United States and many European countries.

This year's theme was selected because information systems have offered widespread applications in education, government, industry and science. The bulk of research in computer and information science is now oriented to the development of improved information systems.

COINS-72 is cosponsored by the U.S. Army Research Office, Durham, N.C., the U.S. Atomic Energy Commission, Washington, D.C., and the University of Florida in Gainesville.

STINGER

Redeye Missile Replacement Being Developed for 1980s

Replacing the Redeye missile system will be the job of Stinger, a man-portable system being developed by the Army with a number of improvements over its 14-year-old air defense predecessor.

Although certain specifications are still classified, Stinger will be 10 inches longer and about two pounds heavier than Redeye. Gunners, however, are not expected to notice any appreciable difference while operating Stinger.

Another feature of Stinger will be an IFF (Identification Friend or Foe system) incorporated as an aid to gunner recognition.

Since it will be treated as a "wooden" round, Stinger will not be subjected to any maintenance from manufacture to firing. As a result, the Army does not intend to develop maintenance test sets to be fielded with the new weapon.

The last delivery of Redeye was completed in July 1971, representing a milestone in a chain of events dating to 1957 when the Redeye concept was proposed by General Dynamics.

Redeye was conceived as a self-defense weapon employed to protect the small area of a frontline combat unit. It was expected to perform its mission either by destroying enemy aircraft or, by its presence, forcing transiting aircraft to an altitude where attack by the Hawk missile became feasible.

Additionally, the Army has fielded Chaparral to provide area coverage throughout the combat division against aircraft flying below radar mark, and Vulcan to furnish defense of high-point targets against attacking aircraft.

STINGER man-portable air-defense system

Redeye has proved an extremely accurate and highly reliable system. Stinger, now in the engineering development stage, is expected to exceed Redeye's capabilities in the 1980s. General Dynamics is the contractor.

For some time the United States has been looking for a man-portable system to replace Redeye, which is in the hands of both the Army and the Martine Corps. Based on the Projected capabilities of the threat, studies have determined that the next man-portable air defense system (MANPADS) must possess additional capabilities over those of the Redeye. A number of product improvements on Redeye were discarded in favor of developing Stinger for an air defense role in the future.

In the meantime, Chaparral and Vulcan will continue to assist Redeye in overall forward area low altitude defense. The shelf life of Redeye has been extended, and it continues to serve the Army as an effective air defense weapon.

MERDC Develops Mobile Unit For Rapid Water Purification

Water contaminated with radioactive materials can be purified at the rate of 3,000 gallons an hour for field consumption by using a mobile ion exchange unit developed by the U.S. Army Mobility Equipment R&D Center.

Developed by the Sanitary Sciences Division at Fort Belvoir, Va., the unit is installed in a transportable shelter. It consists of two pressure tanks, each containing 21 cubic feet of cation or anion resins.

The ion exchange resins are capable of being chemically regenerated on site when exhausted. The remaining equipment includes piping, valves, flow meter, conductivity meter, pumps and a hot air heater for cold weather operation.

The system will permit treatment equivalent to standard military water purification equipment. Mounted in a 5-ton military truck, or equivalent vehicle, it weights 7,290 pounds, including a 10½′ × 7′ × 7′ shelter.

R & D
NEWS

Largest U.S. Balloon Launched at White Sands

The largest balloon yet fabricated in the United States was launched Sept. 18 in one of the most comprehensive atmospheric sampling experiments at the float altitude of 160,000 feet ever attempted at White Sands Missile Range (WSMR), N. Mex.

In flight for six hours, the 38 million cubic-foot vehicle carried a payload of sensing instruments that successfully performed 20 experiments. Project manager Harold N. Ballard said: "Although the flight was scheduled for 10 to 12 hours, it was terminated early to prevent loss of the payload in the nearby mountains."

The project was a cooperative endeavor of the U.S. Army Electronics Command's Atmospheric Sciences Laboratory (ASL) at WSMR, the Air Force Cambridge (Mass.) Research Laboratories, and Sandia Laboratories, Albuquerque, N. Mex.

The project was conducted in a contractor capacity by the University of Texas at El Paso, Pennsylvania State University's Ionospheric Laboratory, and Panametrics, Inc., of Waltham, Mass.

First large-scale effort by ASL to obtain meteorological information in the stratosphere since 1969, this experiment was a continuation of previous efforts to acquire information about the atmospheric composition at the 160,000-foot altitude.

When activated, the sensing instruments measured detailed time and space variations in the chemical composition of the atmosphere and related meteorological parameters. Two of the most important experiments involved a mass spectrometer and an ultraviolet photometer to obtain atmospheric composition measurements.

In addition to the 250-pound sensor payload, the balloon carried 411 pounds of control equipment. At float altitude the payload was lowered by radio command to 1,500 feet below the balloon to reduce the possibility of atmospheric contamination through the presence of polyethylene balloon material.

Telemetry transmitted the data to ground receiving stations at Holloman Air Force Base, N. Mex., WSMR's Small Missile Range, Springerville, Ariz., and Fort Huachuca, Ariz. At flight termination the payload was separated from the balloon by radio command and parachuted to the ground.

The information obtained during the flight will be used in missile reentry studies and a number of Army missile research projects. The balloon is a relatively low cost means of providing a stable platform for taking atmospheric measurements at high altitudes.

Battelle Lists Publications

The second annual compilation of publications authored by its worldwide staff has been published by the Battelle Memorial Institute.

Titled "Published Papers and Articles 1971," the 32-page document includes writings that have appeared in scientific and technical periodicals, professional-society proceedings, and other technically oriented publications.

Copies are available from: Battelle, Columbus Laboratories, 505 King Ave., Columbus, Ohio 43201..

Air-Cushioned Vehicles Viewed for Travel in 1980s

Rail service to Washington, D.C., from Northeast Corridor cities as far north as Boston will be upgraded in the 1970s and air-cushioned vehicles running on guideways will be operational in the 1980s—IF.

The IF involves what action the U.S. Department of Transportation (DOT) takes on recommendations submitted by the National Bureau of Standards to meet ground transportation requirements in this densely populated corridor.

The NBS proposals, however, are only part of numerous suggestions for solutions to the complex traffic issues expected from other teams that are studying modes of transportation—as a basis for DOT decisions that will relate to needs in future decades.

With respect to air-cushioned vehicles, the NBS recommendation is interesting in that the U.S. Army had a pioneering role in what were termed ground effects machines (GEM) more than a decade ago. Much of the technology originated through early U.S. Army support of this development is, in fact, now being considered by the Canadian military establishment to meet certain transportation requirements in the Far North.

The Northeast Corridor is a 500-mile strip of land along the Atlantic Coast from southern New Hampshire to Norfolk. Consisting of about two percent of the nation's land, it is peopled by a fifth of its population. It is estimated that by 1985 the Corridor's population will have increased 25 percent.

This population growth and the appearance of new communities will produce more commuting and pleasure travel and an increased flow of commerce. To accommodate this growth, the capacity of the travel modes available will have to be increased and possibly whole new transportation systems created.

Anticipating the increased demands for service, the Department of Commerce established the Northeast Corridor Transportation Project (NECTP) in 1965 and assigned NBS, among others, to evaluate future transportation needs.

NECTP was transferred to the Department of Transportation when it was formed in 1967, and the reports from the studying agencies were compiled in December 1969.

These reports analyzed various present and planned travel modes in the corridor; still needed was the formulation of policy recommendations by the DOT. NBS was asked to assist in developing recommendations for high-speed ground transportation.

This led to formation of a team of system analysts from NBS's Institute for Applied Technology. First they considered the costs and effectiveness of several proposals for upgrading and augmenting present Washington-to-Boston rail service.

This was done by estimating direct operating costs (energy, crew and vehicle maintenance), indirect costs, and system investment costs. Next, passenger volumes were estimated for each proposed system and for use as reference points in estimating future demands.

The analysts first concluded that the best way of increasing rail capacity from Washington to Boston would be to upgrade the right-of-way and improve equipment for the existing service.

Travel times would be expected to be approximately 2 hours for the Washington-to-New York run and 2¾ hours for the New York-to-Boston trip. Capital required would be approximately $290 million for right-of-way improvements, $70 million for terminal improvements, and $100 million for vehicle construction.

The NBS team also recommended that work should be started on plans for a new system, not necessarily like present ones, and that a definite commitment be made by the late 1970s. It was recommended that a system using tracked air-cushion vehicles be considered for this phase of the program.

NBS recommendations for high-speed ground transport will have to be consolidated by DOT with those for the air and highway transportation systems to establish unified goals for Northeast Corridor Transportation.

Planning use of the total systems approach is an example of the development of coordinated, long-term plans through federal initiative.

New Simulator Aids Illuminating Flare Tests

An air drop simulator to test illuminating flares under conditions realistically approximating field conditions has been added to Picatinny Arsenal research and development facilities.

Serving the Pyrotechnics Division of the Feltman Research Laboratory, the simulator enables researchers to conduct static testing of illumination flares without resort to former methods—using guns to fire them high into the sky or dropping them from aricraft, to illuminate the ground as they descend by parachute.

For purposes of development and acceptance testing, the light output of flares is measured in flare tunnels. The flare's light output is not fixed like a lamp; it varies both in direction and time.

Although excellent for comparison of rounds, the tunnel is not able to measure the light output that flares produce under actual field conditions.

Consequently, other facilities were required to create a closer approximation to dynamic conditions. A 126-foot tower was erected in the Picatinny area several years ago so that flares could be suspended in the air as they are beneath a parachute. Photocells were positioned on the ground in concentric circles so that the flare's illumination could be measured over the area below.

This facility was a considerable improvement, but test conditions did not include the effects on a flare's light output due to air movement past the flame while dropping beneath a parachute.

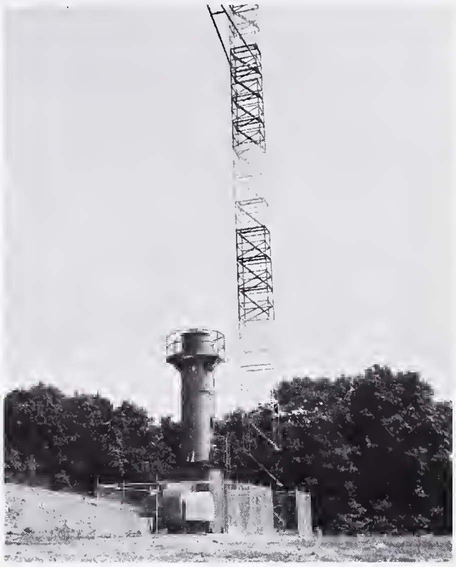
The design of a dropping apparatus at the tower to provide this effect was rejected because of the complexity it would add to illumination measurements. Moreover, space positioning equipment would be required. It was decided that smooth air movement past the flame at controlled velocities would closely approach the desired dynamic condition.

An air drop simulator was then designed and fabricated in-house and erected at the flare tower facility. It consists of a 26-foot-high stack, 4 feet in diameter; a variable speed (up to 18,000 cubic feet per minute) blower fan; and clustered air-flow tubes within the stack. The air flow extends at least six feet above the top of the stack, where the test flare is suspended, and the velocity can be varied from 5 to 20 feet per second.

The air drop simulator was conceived and planned by the Electronics and Photometric R&D Branch of the Pyrotechnics Division.

During the past few years, the E&P Branch designed and developed a pyrotechnic evaluation range which is operative at Yuma Proving Ground, Ariz. This installation has hundreds of photo-cells placed in an 8,100-square-foot area, and is used for measuring the ground illumination produced by flares under actual field conditions.

Picatinny Arsenal plans to compare data from the air drop simulator with data taken at Yuma.



Flare Air-Drop Simulator and Tower

NBS Investigates Neutron Radiation For Potential Use in Cancer Therapy

Cancer therapy by use of fast neutrons is being investigated by scientists at the National Bureau of Standards (NBS) as a possibly improved method in treating some types of tumors.

Hopefully, this fundamental work will increase knowledge of the effectiveness of different radiations. Fast neutrons are believed to kill oxygen-deficient cancerous cells in the center of tumors, using less radiation than conventional X-ray methods.

Advantages of neutron utilization would thus include a decreased amount of damage to healthy tissue surrounding the cancer.

R. S. Caswell and J. J. Coyne of the NBS Center for Radiation Research have developed theoretical calculations concerning neutron energy transfer to tissues. Neutrons initially interact with the atomic nuclei of tissue, producing secondary particles such as protons, alpha particles, carbon, nitrogen, and oxygen recoil nuclei.

Secondary particles transfer the neutron energy to the biological material. As the neutron tissue interaction occurs, other energy transfer systems arise, presently requiring further study.

APG Evaluates Latest Towed Weapons System

Two advanced development models of the Army's new XM198 howitzer, a 155mm towed weapons system, are undergoing design and durability testing at Aberdeen Proving Ground (APG), Md.

Designed to provide an increased rate of fire with much greater range than its predecessor, the M114A1, the new howitzer uses a unique fire control system and is adaptable to air mobility.

A primary feature of the XM198 is a fire control system utilizing radioactive self-illumination to assist in night firing. The system eliminates the need for batteries, wiring and other vulnerable components of fire control instruments currently in service.

Donald K. Tag, chief of the Materiel Testing Directorate's Artillery Weapons Branch, said the XM198 models at APG are being subjected to both firing and roadability testing. Firing durability tests are using standard 155mm rounds with inert-loaded projectiles.

With a formidable appearing tube eight feet longer than that of the M114A1 howitzer, the XM198 has an azimuth bearing system for rapid sight resetting. It has the capability of traversing a full 360 degrees in minimal time through the application of a hydraulically operated lift.

The maximum muzzle velocity of the XM198 is 2,740 feet per second, as compared to the 1,850 feet per second rate of the M114A1.

Current APG firing tests are being conducted with the standard 155mm round. The XM198 also is designed to fire a streamlined high-explosive shell with a rocket-assisted projectile mid-course booster to give extended range, meanwhile retaining the capability of firing 155mm ammunition.

Tag said the new weapon is emplaced and deployed more rapidly than the M114A1 and has a designed weight of 14,600 pounds. This permits transport by the Chinook helicopter.

Under the direction of test director James S. Whitcraft, 15,000 rounds will be fired from one of the two weapons at APG. The test program will record range precision, along with instrumented firings for carriage recoil and cannon functional characteristics.

The bulk of the firing tests will determine durability and tube wear, with a target schedule of 100 rounds per firing day. After every 400 rounds fired, the weapon will undergo a 100-mile night run. Six tubes will be utilized during the firing program, expected to be completed by March 1973.

Simultaneously, the second of the two advance development models is undergoing standard road and endurance tests under the guidance of test director Paul R. Grepps.

Both wheeled and tracked vehicles are employed in cross-country mobility towing tests over varied types of terrain and roadways, including the Belgian Block Strip, which is comparable to a cobblestone roadbed.

Further testing of the weapon will be made on grades and slopes of as much as 40 degrees. Side slope courses will be utilized to determine the degree of potential "tipping."

Data obtained through tests will be applied to the design of eight prototypes of the system. Being manufactured at Rock Island Arsenal (RIA), Ill., these will be scheduled for engineering tests next year.

While RIA will manufacture the major components of the carriage and recoil mechanism, Watervliet (N.Y.) Arsenal will forge the cannons and Frankford (Pa.) Arsenal will supply the fire control equipment. The weapons will then be assembled at RIA.

ZM198 is shown in action as the 155mm weapon system blasts out one of 15,000 rounds scheduled during design and durability testing at Aberdeen PG, Md.

MERDC Saves $3.4 Million In FY 1972 Cost Reduction

Cost Reduction Program savings of $3,493,000 for FY1972 were reported recently by the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. This total exceeded by 179 percent the quota assigned by the U.S. Army Mobility Equipment Command.

The largest savings are attributed to procurement and engineering policies related to the family of military standard diesel engine driven generator sets. A multiyear procurement resulted in a saving of $1,476,000.

Engineering support for the Universal Engineer Tractor (UET) and improved negotiating techniques for procurement resulted in a revision of delivery schedules and use of government-furnished rebuilt components to produce a $590,000 cost reduction.

A saving of $338,000 was achieved when it was determined that the government could furnish a contractor with certain materials more economically, and $45,800 was saved on tractor units through elimination of some parts. Standardization of voltage regulators on the 3-, 5-, and 10-kw generator sets cut costs by $96,500.

R&D NEWS

Army Tests Device for Arctic Ice Measurements

Measuring the thickness of sea ice in Arctic waters is the purpose of a device presently undergoing a series of tests in the broad plains at White Sands Missile Range, N. Mex.

As unlikely as it seems, the U.S. Coast Guard is sponsoring the final production model tests of the Sandia Laboratories' Sea Ice Penetrometer (SIP) in an environment where summer sun can push the mercury to well over 100° F.

Shaped like a pencil with fins, the Sea Ice Penetrometer has great potential for helping ships navigate ice fields in Arctic waters.

At WSMR the SIP units are dropped from an aircraft at 8,000 feet. As the penetrometer hits the gypsite soil the device separates, leaving the tail section and its antenna protruding above the surface. The nose portion, containing telemetry gear, continues into the earth, playing out an electrical cable connected to the antenna.

This permits transmission of data from the stationary antenna while the front section of the SIP continues to penetrate. The aircraft continues to circle after dropping the penetrometer to gather data in its recording station.

Resident test conductors at WSMR for Sandia Laboratories report that the soil there is harder than Arctic ice and provides an "overtest" for the SIPs. Tests are expected to prove the worthiness of the expendable air-dropped penetrometers, designed to measure quickly and remotely the thickness and other characteristics of sea ice in polar regions.

Ice thickness measurements are presently made with hand-operated core drills and are limited to areas accessible by ship or helicopter. The penetrometers will enable the Coast Guard to advise ships where to find the thinnest ice in the area; also, to determine the best routes for ships exploring new shipping lanes.

"Since the soil here (WSMR) is harder than Arctic ice, where the penetrometer will be used, the test units are exposed to additional stress," noted Robert Male, resident test conductor at WSMR. "If the penetrometer will work here, we know it will work in Arctic ice."

Final production model tests of the Sandia Laboratories Sea Ice Penetrometer were conducted at WSMR's Northrup Strip.

WECOM Allocates $10 Million For Modifications, Components

Two weapon components production orders totaling nearly $10 million will create more than 216,000 man-hours of work at Watervliet Arsenal, N.Y., between now and August 1974.

The U.S. Army Weapons Command (WECOM) orders are for modification kits for the tube assembly of the 155mm self-propelled howitzer; also, for modification kits and new components for 152mm gun launcher breech mechanisms.

Modification of the 155mm to increase the weapon's range requires a longer gun tube, a traversing mechanism, suspension system, elevating mechanism and travel support lock. The job also involves extensive environmental and endurance testing.

Manufacture of the kits, which will take place between April 1973 and August 1974, will require 188,932 man-hours.

Modification of the breech mechanism for the 152mm gun launcher, which arms the M60A2 tank, also requires fabrication of new launchers and extra tubes. This work, requiring 27,815 man-hours, will be performed between January 1973 and June 1974.

Picatinny Uses Nuclear Radiation for Food Analysis

Nuclear radiation technology used initially for nondestructive testing of explosives is now serving to test food products at Picatinny Arsenal, Dover, N.J.

The radiation facility of the Feltman Research Laboratory's (FRL) Explosive Division is measuring the moisture content of powdered, dehydrated and other foods supplied by the U.S. Army Natick (Mass.) Laboratories.

A food sample is subjected to a beam of neutrons from a tiny capsule containing a radioactive material such as californium 252 or a mixture of plutonium and beryllium. The fast neutrons are emitted with an average energy of two to three million electron volts.

Upon passing through just a few centimeters of hydrogenous material, such as RDX, TNT, or propellant grains, a large number of these fast neutrons are slowed down and reduced in energy to only a fraction of one electron volt.

Hydrogen, of all the elements in nature, has proved the most efficient for slowing down fast neutrons. By placing a special detector sensitive only to slow neutrons on the other side of the sample, a signal is obtained at a level that can be related to the hydrogen content of the food sample.

Since water contains more hydrogen than most other common organic materials, this principle can be used as the basis for a moisture measurement gauge. The greater the moisture content, the larger will be the signal variance over that from a completely dry sample.

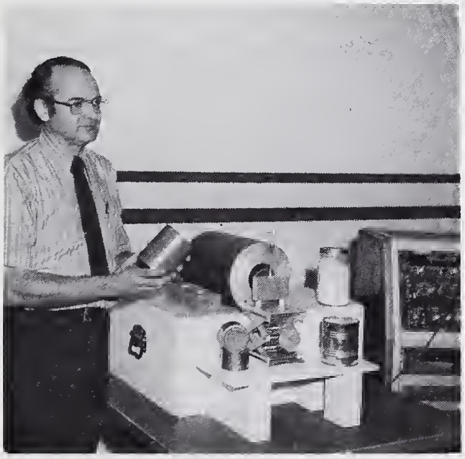
The particular advantage of this neutron gauging technique is that the moisture measurement can be made with the food sample completely sealed in a metal container. The neutron source is small enough so that it can be safely handled manually by the operator. Also, no measurable changes are produced in the sample.

The original nuclear radiation nondestructive testing of explosives was done by Samuel Helf, specialist for nucleonics, and Stanley Semel, research chemist, both with the FRL Explosives Division.

Technologists at the Army Materials and Mechanics Research Center (AMMRC), Watertown, Mass., learned of this method and are now providing the support to extend this technique to the testing of food products.

Materials to be tested by the neutron gauging process include flour, potato granules, powdered eggs and milk, ground meat, dehydrated orange juice and a variety of canned Army foods.

The work at Picatinny Arsenal will be coordinated with food scientists from the Army Natick Laboratories. Ultimately, it is hoped that this technique can be applied to the routine testing and quality control of packaged and canned Army foods.



NUCLEONIC SPECIALIST Samuel Helf is shown at the neutron gauge used for measuring moisture in Army food products at Picatinny (Dover, N.J.) Arsenal.

Repair Parts Retrieval System Initiated

A new $1.24 million automated parts storage and retrieval system is in operation at the U.S. Army Materiel Command's Anniston Army Depot, Ala., in support of maintenance rebuild activities.

The system consists of three major elements: a powered manual and computer-controlled materiel input and output conveyor system, materiel storage bank with computer-controlled pallet storage and retriever units, and a computer data bank control system.

The function of the system is to assure instant availability of repair parts to several shop activities while providing records and other data for use in production and inventory control.

The system is designed for storage of new parts, in-process assemblies and reclaimed materiel. It has 113,000 cubic feet of storage space serviced by three stacker cranes. Under computer control, the cranes can move 720 pallets of materiel, weighing up to 600 pounds each, in an 8-hour work shift.

The maximum storage capacity is 4,368 pallets arranged in six rows, 48 feet high by 188 feet long. Through computer direction, any individual pallet in the system can be retrieved and moved to the output conveyors within three minutes. The computer can maintain data on 43,000 line items of materiel, and accepts as high as 100 commands for automatic retrieval at a time.

Retrieved items are directed by the computer to a designated work area within the system for consolidation with other materiel, or to an output conveyor for transportation by fork truck to rebuild and assembly lines to support the depot's mission for combat vehicles.

Alstatt Heads New Directorate Of Army Medical R&D Command

Formation of an Environmental Quality Research Directorate within the Army Medical Research and Development Command, with COL (Dr.) Leslie B. Alstatt (Medical Corps) as chief was announced recently by the Office of The Surgeon General, HQ DA.

Areas of research for which he is responsible include biomedical stress, drug and alcohol abuse, environmental effects, aviation medicine and sanitary engineering.

Dr. Altstatt returned recently from a 3-year tour in Bangkok, Thailand, where he was director of the U.S. Army component of the Southeast Asia Treaty Organization (SEATO) Medical Research Laboratory.

A 1956 graduate of the School of Medicine, Vanderbilt University, Dr. Altstatt was commissioned in the Army Reserve from the ROTC Program at the University of Arizona, but was not called to active duty until he transferred to the Medical Corps. He took his internship and residency training in pediatrics at Letterman General Hospital, San Francisco, and was certified by the American Board of Pediatrics in 1962.

Dr. Altstatt served as a pediatrician at Tripler U.S. Army Hospital in Hawaii, then took the Military Medical and Allied Science Course and served a fellowship in hematology, both at Walter Reed Army Institute of Research (WRAIR). He was special assistant to the director of WRAIR and associate commandant for three years until reassigned to Thailand.

Solder Joint Stress Examined By Holography Techniques

Holography is being applied to nondestructive testing of solder joints and is believed to be the first positive technique for correlating stress with load to predict the lifetime of printed electronic circuit boards.

The hologram stores both phase and amplitude information, and can be used in two ways to determine the stress in solder joints.

In the first method, a double-exposed hologram is used, the first exposure being made with the test sample under no load. After a load (thermal, mechanical, etc.) is applied and the second exposure made, the hologram reveals the displacements in the test sample caused by the stress. This is shown as a set of fringes around the image of each part of the test sample.

The fringe spacing indicates the amount of displacement—the larger the displacement, the smaller the fringes. Thus, the relative motion of each component on the test sample can be determined. By knowing this, the amount of stress induced by the load can be calculated.

The second method produces the same results, but it operates on a real-time basis. A hologram of the test sample under no load is made, developed, and returned to its original position in the apparatus. The image is exactly superimposed on the original test sample. If no change occurs, only the illuminated sample is seen through the hologram.

When a stress is applied, fringes will appear as the displacements occur, and the development of fringes may be observed in real time. The analysis of stress from the observed fringes is the same as in the first method.

Further information on this development is available on request from: Technology Utilization Officer, Marshall Space Flight Center, Huntsville, Ala. 35812. Reference: B70-10123.

Federal Agencies Responding to Technology Transfer Goals

Federal agencies are accelerating efforts to increase the transfer of science and technology for applications to the nation's social and economic problems, in line with recent White House and Senate actions.

The National Science Foundation, the National Bureau of Standards, the Department of Defense and other major agencies are acting under the mandate of President Nixon in an address to Congress on "Science and Technology." (See feature article, page 12, in the May-June 1972 edition of the *Army Research and Development Newsmagazine.*)

The "National Science Policy and Priorities Act of 1972," as reported on page 4 of the September edition of this publication, was passed by a 70 to 8 vote of the Senate. It provides for expenditure of $1,025,000,000 over a 3-year period to augment civilian R&D expenditures.

This program would include establishment of a Civil Science Systems Administration within the National Science Foundation, along with the formation of a 31-member Civil Science Systems Advisory Council. As envisioned by some members of Congress, the program ultimately would be expanded to approximate the annual Department of Defense R&D expenditures.

The National Science Foundation called a press conference following a late September meeting in Washington, D.C., of more than 50 of the nation's largest and most prestigious trade and professional associations for a briefing on an "Experimental R&D Incentives Program."

A program announcement circular distributed at the press conference explains that the program "results from a growing recognition of the importance of technical innovation in maintaining international competitiveness and meeting growing domestic needs."

The NSF is interested in identifying and testing "Federal incentives that would: (1) promote a more rapid transfer of technology to the public and private sectors of the economy; and (2) in the long run, stimulate greater non-Federal investment in R&D."

Experiments conducted under the program will involve close cooperation between two or more of the following: universities, colleges, profit and nonprofit research institutes, industry and industrial trade associations, U.S. Government laboratories, state and local governments, and public service industries and institutions.

The program will support (1) background studies to identify and understand barriers and blockages in the technical innovation process in selected areas of application. The circular states:

"Special but not exclusive attention at the beginning of the program will be given to industries with little or no R&D, small, high-technology industries utilizing research from other sources, fragmented industries whose individual companies cannot support research, and industries with fragmented and variable market requirements."

The program calls for experiments designed to investigate the incentives intended to overcome these blockages. Explained further is that:

"This program does not have as an objective the support of basic or applied research, *per se,* nor is it intended that it will serve as a mechanism for augmenting R&D budgets of industries, public service companies, universities, etc."

Support will be provided to experiments in both the private and public service sectors. Guidelines for acceptable project proposal are:

- The identified barriers and incentive mechanism should be of a *general nature* and not specific to a particular case.
- There should be a credible relationship between the incentives proposed and the barriers to which they are addressed.
- The experiments proposed should identify measurable outputs or results which can be used to evaluate the efficacy of the incentives being tested.
- An incentive proposed for experiment should be suitable for evaluation with a view toward federal policy action.
- There should be a significant commitment of non-federal resources and clear identification of their magnitude relative to federal funds required over the lifetime of the experiment.
- The potential socio-economic impact of the proposed incentives should be discussed.

The objective of the program is not to bring any specific product, process or service to the marketplace. It is recognized, however, that it may be necessary to do so for the purpose of conducting a valid experiment on incentives for the removal of barriers to innovation.

In such cases, additional conditions to be satisfied include:

- Essentially all the required materials and facilities should be in existence.
- There should be a high degree of probability that the product, process or service to be developed in the proposed experiment can be marketed or used.
- The end user, or institution, that will use the product or service, or bring it to the marketplace, should be strongly involved in the experiment.
- Assurance should be given that the full results of the experiments will be made public.

Cost sharing on such unsolicited research proposals is required by statute. Organizations proposing to participate in the experimental program are expected to demonstrate their commitment by agreement to cost sharing on a basis commensurate with the potential financial benefit to themselves.

R & D NEWS

MICOM Modifies Shillelagh For Use With M-60 Tank

The Engineering Services Division of McMorrow Laboratories, U.S. Army Missile Command, recently completed a modification program making the Shillelagh missile compatible with the M-60A2 tank.

Changes were in line with duties assumed last year of providing engineering services for Army missiles no longer in production.

Failure of the aft cap on the Shillelagh missile to eject following its firing in the M-60 tank prevented subsequent rounds to be loaded into the chamber. MICOM engineer Donald Sandidge found the problem to be faulty shock absorber rings which fit around the aft cap.

Redesign of the absorber rings and subsequent testing by the Test and Reliability Evaluation Laboratory proved the modification a success. Quantity production of the new shock absorbers is planned with final adaption to the Shillelagh missile accomplished by several Army depots.

Shock Machine Designed for Safeguard Evaluation

Durability of Safeguard Ballistic Missile Defense System equipment under nuclear atack conditions will be evaluated by using a biaxial shock test machine designed by the U.S. Army Construction Engineering Research Laboratory.

After assessing limitations of existing test methods, CERL's Construction Systems Division (CSD) at Champaign, Ill., and the Huntsville, Ala., Division Corps of Engineers, came up with the new concept. It incorporates state-of-the-art electrohydraulic and machine control techniques in a configuration that has never been attempted in shock testing machine design.

Scheduled to be operational in 1973, the machine will be capable of reproducing time-motion histories to match the shock spectra of a nuclear attack. A closed-loop feedback control system samples motion at the 12′ × 12′ test platform to compare with motion-time histories programed into the machine.

A digital computer system adjusts for any error that is detected. The machine is designed to reproduce a peak vertical spectrum displacement of 4 in.; a spectrum velocity of 150 in. per sec.; and an acceleration of 40 g's. Its peak horizontal spectrum displacement is 4 in.; spectrum velocity 150 in. per sec.; and acceleration 20 g's.

CSD will test approximately 28 percent of Safeguard's critical electromechanical equipment (varying in weight from 1,000 to 12,000 lbs) by subjecting it to motion spectra characteristics of the nuclear environment inside a structure.

Aside from its primary purpose, the shock test machine also may be used to evaluate the ability of structures to withstand earthquake damage. Models of structures can be subjected to "earthquakes" programed to simulate motion at the actual building site. Other uses for the machine include testing the durability of shipping containers and general equipment.

The machine will cost around $2 million and be housed in its own building at the University of Illinois Research Park where CERL is located. Construction of the building is scheduled to begin this summer. The machine is being fabricated by MTS Corp., Minneapolis, Minn.

Decade of Harmony

WSMR Gains Trust in Off-Range Firing Program

Off-range launching of U.S. Army missiles—from areas involving flight across land owned by thousands of ranchers and farmers in a 4-state area to impact 400 to 500 miles away at White Sands (N. Mex.) Missile Range—is nearing a decade of real harmony.

In the realization that the missiles are being tested in developing the United States' defense posture, owners of millions of acres of private land or in the public domain have cooperated with WSMR leaders in a spirit of trust and confidence.

Since the first Pershing artillery ballistic missile was successfully launched from Fort Wingate, N. Mex., in October 1963, some 160 of the 10,000-pound vehicles have roared from launchers there and from southeastern Utah at Gilson Butte, Blanding and Green River.

Hundreds of other missiles, including Army Sergeants and Air Force Athena and Hound Dog missiles, have been test fired during the same period from off-range sites in the Four Corners area to impact areas on White Sands Missile Range.

The Army's need for off-range launch sites evolved with missile technology. During the 1950s the emergence of highly sophisticated and powerful missiles and rockets made the 100-mile-long White Sands Missile Range a less desirable test location.

In the face of potential public concern over an Army "land grab," and public apprehension of missile flights above populated areas, WSMR officials early in 1962 were faced with the requirement to establish missile launch sites as far as 400 miles beyond the range boundary.

Essential to success of this effort was public acceptance of the program in the Four Corners area so that needed land for launch sites could be obtained. Planning was based on three initial test series involving the Army Sergeant from Datil, N. Mex.; the Army Pershing from Fort Wingate and Blanding; and the Air Force Athena research vehicle from Green River.

The public had to be convinced the missile tests were necessary to the national defense efforts, were completely safe, were normal operations made possible by advances in the art of missilery, and that utilization of the land involved would be on a temporary basis.

WSMR officials briefed congressional delegations, state governors, city officials, and gave special briefings to the news media in New Mexico, Utah, Colorado and Arizona.

Films and displays were produced to portray all possible aspects of the program. News releases from WSMR stressed the rigid safety precautions and explained the necessity for off-range testing.

Much of the off-range flight corridor between Green River and White Sands Missile Range lies within the Navajo and Ute Indian domains. A special effort was needed to explain the program to these people, long conditioned to distrust the "white man."

Interpreters were commissioned to visit the lodges of chiefs to explain—to them and their people—in their own tongue the necessity and safety of overflights. A movie narrated in Navajo was produced for showing in the Indian country.

Because of the complexities involved in launching missiles, exhibits also were used to explain the many parameters of an actual missile launch, flight and recovery. Most notable among these was a 5-unit electronic exhibit complete with continuous play tape recorders, movies and still picture projections to tell the WSMR story.

In 1963 the New Mexico governor, Jack M. Campbell, said the Army's off-range firing program was "safer for New Mexicans than driving on highways." Since 1964 the over-flight missiles have not injured any person in the public domain.

An occasional malfunction results in flight safety personnel aborting a missile flight. Following impact, recovery crews are dispatched to the scene immediately to retrieve the components and to restore the area to its original condition, for safety purposes as well as ecological purposes.

Less than a score of missiles, including Pershings and Athenas, have landed out of the safety zones provided. However, no property damage has occurred and WSMR officials report that there has been no significant public concern.

Major Army RDT&E Contracts Exceed $275 Million

Army contracts for research, development, test, evaluation and materiel or service procurement, each exceeding $1 million, totaled $275,681,906 during September.

Chrysler Corp. is receiving $99,435,340 for M60A1 and M60A2 tanks. FMC Corp. will be paid $25,195,705 for the M113A1 series of vehicles and Kentron Hawaii, Ltd., gained a $13,032,175 contract for technical support of the Kwajalein Missile Range. RCA Corp. was awarded $10,910,000 for work on the signature and metric measurement from missiles and space objects with TRADEX/ALCOR. Philco Ford Corp. will receive $10,500,000 for classified electronics.

Contracts under $10 million. AEL Service Corp., $8,519,962 for design, fabrication and testing of radio receiving systems; Raytheon Co., $7,902,000 for M905 bomb fuzes, for M904E3 fuze parts and Dragon missiles; United States Steel Co., $7,640,709 for metal parts for the M106, 8-inch projectile; Marathon LeTourneau, Inc., $7,220,000 for parts for the M117A3, 750-pound bomb; and

Sperry Rand Corp., $7,097,000 to furnish, install and maintain a security system for a Safeguard site; Research Analysis Corp., $7,039,783 for research, scientific studies and reports for improved Army tactical operations and R&D materiel requirements forecasting; Western Electric Co., $6,124,847 for Nike Hercules modification kits; GTE Sylvania, $5,528,125 for work on signature and metric measurement from missiles and space objects, using ALTAIR.

Contracts under $5 million. American Air Filter Co., Inc. $4,326,000 for a shelter system; Magnavox Co., $4,266,000 for development, fabrication and test of the AN/USC-28 radio subsystem; Norris Industries Inc., $4,142,860 for M485A2 155mm, illuminating projectile parts; Institute for Defense Analyses, $4,000,000 for studies and analyses of politico-military objectives, budgets, technology, basic and advanced R&D development, weapons system studies, net technical assessments, and military manpower supply; and

Tasker Industries, Inc., $3,901,600 for M83A3, 60mm illuminating cartridges; Hughes Aircraft Co., $3,428,969 for AN/VVS-1 laser range finders, and repair parts for radio sets and battery boxes; AMBAC Industries, Inc., $3,098,050 for M49A1 surface trip flares and M83A3, 60mm illuminating cartridges; Teledyne Continental Motors, Inc., $2,718,000 for engineering support for the AVDS-1790-2A series engines; and

AVCO Corp., $2,468,490 for booster adapters; National Union Electric Corp., $2,447,850 for fuze parts; LTV Aerospace, $2,396,687 for ground support equipment for the Lance missile; Martin-Marietta Corp., $2,173,378 for modification kits and engineering services for the Pershing missile system; and

Bendix Corp., $2,070,000 for platforms for the Pershing missile system; General Motors Corp., $2,051,901 for 6V53 diesel engines; Lear Siegler, Inc., $2,000,000 for classified electronics equipment; International Harvester Co., $1,854,260 for diesel engine tractor trucks; Aerojet Ordnance and Manufacturing Co., $1,705,350 for bomb fuzes; Union Carbide Corp., $1,633,402 for dry batteries for the AN/PRC25 radio; and

Textron Inc., $1,519,975 for rotary-wing blades for the UH-1 helicopter; Kennedy Van Saun Corp., $1,336,300 for 81mm M375A1 projectile parts; Kilgore Corp., $1,322,040 for white star, ground, parachute, illuminating signals; Technology Service Corp., $1,251,318 for test and evaluation of weapons locating radar AN/TPQ37; and

Emerson Electric Co., $1,240,000 for design and fabrication of an aerodynamically neutral spin stabilized III Rocket and launcher hardware for flight test programs; General American Transportation Corp., $1,138,549 for an automated production system for 155mm and 8-inch propelling charges; Firestone Industrial Products Co., $1,045,281 for track shoe parts.

Shea Becomes Project Officer For Army's Dragon Tank Killer

COL John M. Shea, previously a staff officer in Hawaii for the Commander-in-Chief, Pacific, has taken over as project manager for the Army's new Dragon tank killer. Robert Whitley, who was acting project manager, became his deputy to direct development of the shoulder-fired weapon capable of destroying any known enemy armor.

COL Shea served 15 months in Vietnam as commander of the Cavalry squadron with the 25th Infantry Division. He has a BS degree in history from Boston College and an MS in business administration from George Washington University.

His awards and decorations include the Silver Star, Legion of Merit, Air Medal, Joint Service Commendation Medal, and the Army Commendation Medal.

Simulated Nuclear Attack . . .

Interceptor capability demonstrated by target acquisition computed in billionths of second

By LTC Jerry K. Patterson

The dreaded situation; Three nuclear warhead ballistic missiles are streaking toward key targets in the United States at varying angles of approach at more than three miles a second.

The vital question: How capable are proposed ballistic missile defense systems of intercepting and destroying the threat high in the atmosphere?

The rapid response: Guided by information provided by a computer geared to fantastic speed in collecting and analyzing data—providing instructions in billionths of a second—interceptor missiles respond successfully to avert disaster.

That reassuring simulation was demonstrated experimentally and dramatically to high-ranking observers on a realistic attacker-destroyer vehicle display screen when the U.S. Army Advanced Ballistic Missile Defense Agency recently dedicated its $25 million ABMDA Research Center.

Located about half a mile from HQ U.S. Army Safeguard Systems Command at Huntsville, Ala., the ABMDA Research Center is designed to function as *a vitally powerful tool* in developing the nation's ABM defense capability.

THE AUTHOR observes postulated position errors on typical candidate trajectories for incoming reentry vehicles. The console is one used by scientists and engineers at the ABMDA Research Center to study ballistic missile defense systems.

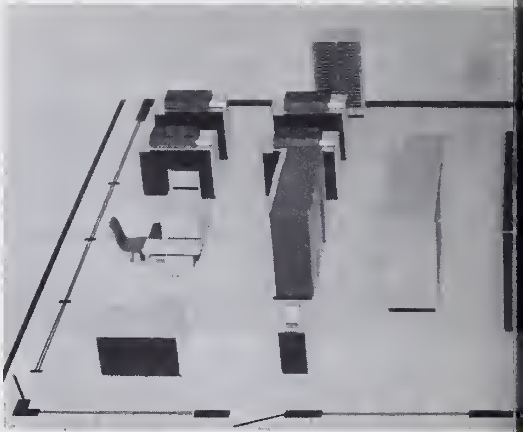
Faster computers are on the drawing boards (see page 12 article in the March-April 1972 edition of the *Army Research and Development Newsmagazine* describing PEPE—Parallel Element Processing Ensemble.)

But until PEPE, being developed under an ABMDA contract, becomes operational in FY 1974, the ABMDA Research Center in the Huntsville Research Park will use the U.S. Army's fastest computer, though others will be tested. Currently, it is the fastest computer in the Southeastern United States—a Control Data Corp. Model 7600 complemented by a CDC 6400 computer providing its high-performance input/output.

The 7600 operates at the speed of one machine instruction every 27.4 nanoseconds (billionths of a second). Its memory has room for 34.62 million bits of information, with access to an additional 5.4 billion bits of storage. Power requirements are large-scale—the center consumes enough electricity to operate more than 100 air-conditioned homes.

Dedication ceremonies Aug. 25 followed by 10 days the successful completion of a 30-day period of acceptance testing for the computer equipment. The 7600 computer sustained its operational status over 95 percent of the time during the tests.

Picture the scene at the demonstration. Seated at the display console of the 7600 system is a tall young engineer. Suddenly, a blinking moving light indicates that a hostile reentry vehicle—known among his colleagues as an RV—has been launched and is making its way over the polar icecap toward the United States. Closer and closer it homes in toward its target.

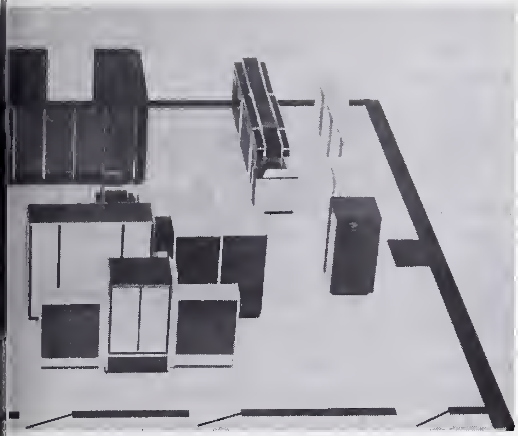


SCALE MODEL of the current computer config
ville, Ala. The center has both a CDC 7600 a
mainframe is the horseshoe-shaped model at t
vanced Scientific Computer is scheduled

Then another blinking moving light flashes on the screen . . . and another . . . and another! The lights trace their way northward across the Arctic sky. As the seconds tick away, the RVs and the interceptors close together at more than five miles a second. Finally, a flashing circle encompassing the extent of the nuclear blast of the interceptor illustrates vividly that the RVs have been destroyed.

Among the dignitaries viewing this awesome spectacle are Senator John Sparkman of Alabama, Mayor

DEDICATION of ABMDA Research Center incl
of Huntsville; Senator John Sparkman of Alab
A. Davis Jr., Director, ABMDA Huntsville Offic



**ion of the ABMDA Research Center at Hunts-
DC 6400 computer. The CDC 7600 computer
enter of the picture. A Texas Instrument Ad-
installation during the summer of 1973.**

Joe Davis of Huntsville and ABMDA Director (Dr.) Jacob B. Gilstein, who has headed the agency since September 1968. Senator Sparkman termed the simulated ballistic missile defense engagement a most impressive performance.

Established in March 1968, ABMDA functions under the Directorate of Advanced Ballistic Missile Defense, Office of the Chief of Research and Development, Department of the Army. Dr. Gilstein heads the directorate, one of four in OCRD, as well as the ABMDA.

ABMDA's mission is to conduct research and development leading to new system concepts and advanced components which can result in significant improvements in the state-of-the-art of ballistic missile defense (BMD).

**ribbon cutting by (from left) Mayor Joe Davis
ABMDA Director Dr. J. B. Gilstein; William
d Dr. Don Dooley, System Development Corp.**

This responsibility involves development of system responses and technology to counter a threat to the national value structure and the United States Strategic Offensive Forces. The areas of advanced development include radar and interceptor missile technology, reentry vehicle discrimination, optical discrimination technology, space defense technology, and advanced defense system concepts.

The BMD community has long recognized that data processing technology has always been a critical path in any developmental effort, and the last element to be completed in any large defense system.

Ballistic Missile Defense, because of its massive complexity, high speed operation, and the intricate interface network between its components, is one of the most difficult technical challenges our country has ever faced. The data processing functions have proved to be one of the most complex segments of that problem. Not only are these functions mathematically and logically complicated, but they must operate on vast amounts of data in a time-critical, real-time environment.

Data must be accepted, responses must be computed, and orders must be transmitted as the natural phenomenology requires it. The criticality of this requirement is vividly illustrated by the fact that a threatening object approaches the earth from outside the atmosphere at speeds of three to four miles a second.

The logic structure controlling the system response must be capable of responding sanely to many varied threats. There has been up to now very little experience or experimentation in the design, description and validation of such advanced logic systems.

As part of the first BMD development effort (the Safeguard System) the Real-Time BMD computer, the Central Logic and Control (CLC), had to be developed by the government together with its corresponding real-time process.

When the Safeguard system computer development effort was initiated, no commercial computer was in existence, or planned, that had the real-time throughput required for BMD. Development of commercial computers has now progressed to the point that the more advanced computers have become candidates for BMD application.

ABMDA's primary developmental

(Continued on page 26)

LTC Jerry K. Patterson is assigned as a ballistic missile defense staff officer in the U.S. Army Advanced Ballistic Missile Defense Agency (ABMDA).

Graduated from the United States Military Academy in 1957, he entered graduate school at the University of Alabama in 1960 and earned an MS degree in physics. He spent his first year with ABMDA (1969–70) performing research on defensive and offensive ballistic missile technology at the MIT Lincoln Laboratory. He is a member of the Army Research and Development Officer Program.

He has served as aide-de-camp to the commanding general, U.S. Army Missile Command (1962–64); chief of Operational Projects, Supply and Maintenance Agency, Europe (1965); and on the staff of the commander, Military Assistance Command, Vietnam (1967–68).

His military schooling included the Basic Infantry Officer's Course and the Airborne and Ranger Courses at Fort Benning, Ga., the Ordnance Career Course at Aberdeen (Md.) Proving Ground, the Army Special Weapons Course at Sandia Base, N. Mex., the Command and General Staff College at Fort Leavenworth, Kans., and the Operations Research/Systems Analysis Course at Fort Lee, Va.

His troop assignments include duty with the 7th Infantry Division in Korea, the 3d Infantry Regiment (Old Guard) at Fort Myer, Va., and as commander of the augmented 545th Ordnance Company (Special Weapons) and Muenster Kaserne in Germany.

Simulated Nuclear Attack . . .

Interceptor capability demonstrated by target acquisition computed in billionths of second

(Continued from page 25)

approach to advanced data processing for BMD has been to take advantage of the rapid progression in the state-of-the-art of computer development.

ABMDA has stressed the development of software techniques which allow advanced BMD requirements to be satisfied efficiently. This has required the integration of the BMD Real-Time Process Design and Implementation with a particular computer configuration to take advantage of the engineering strengths and to minimize the deficiencies of a given computer system.

One of the earliest ABMDA efforts was the Data Processing System Analysis (DPSA) program, designed to be a controlled benchmark from which a data base on BMD candidate computers could be established.

Competitive candidate commercial computers were located around the country and were connected by data link to a central computer on which the simulation software was run. The software simulated threatening objects, interceptors, the environment, and the radar. The candidate computer interacted with the simulation as if it were a real world battle engagement, in which it would determine the reliability of instructions for a ballistic missile defense system.

The data base established from this program was the primary source from which real-time software development for terminal defense is influenced. The DPSA program also served as the data base from which the site defense data processing hardware and software approach were selected.

Although immensely successful, this program did not go far enough in developing and testing large BMD candidate data processing systems. The various components of the tests were spread out too diversely around the country, making it difficult to carry out complex advance interactive testing and developments.

What was needed was a focal point for advanced BMD data processing R&D. It had long been recognized that it would be impossible to field credible radars and interceptors without pilot models to build necessary "know-how." Complex problems of data processing obviously were no different.

Pilot model efforts, it was recognized, were needed in BMD software development, as well as corresponding hardware testing. This approach was essential to establish an experience base in software development for the establishment of performance requirements through the system logic and algorithm development to the coding, checkout, and documentation levels.

Consequently, the ABMDA Research Center was established to close this missing link. Its purpose is (1) to serve as a focal point for developing the methodology for designing and implementing massive complex real-time software processes for BMD; (2) to testing large advanced data processing systems to determine their applicability for BMD; and (3) to test, validate, and demonstrate software processes for specific BMD applications.

The ABMDA Research Center provides for the entire advanced BMD community a centralized, integrated facility for testing proposed solutions to BMD problems.

Twenty separate contractor organizations are using the resources of the ABMDA Research Center on a daily basis. It is expected this number will increase to about 35 firms by July 1973.

The System Development Corp. is responsible for the installation and operation of the ABMDA Research Center, and is tasked to perform a number of related BMD research analysis activities for ABMDA.

The battle simulation observed by the visitors at the center's dedication was illustrative of the type of work which is conducted daily with the ARC. Since the center serves as the focal point for advanced BMD software, and as the testbed for experimental BMD data processing hardware, simulation is used constantly as a system design tool to prove out concepts.

The two primary objectives of this simulation are the synthesis of BMD concepts into coherent, advanced defense system constructs, and the development of the most expeditious and reliable BMD data processing system methods and technology.

Some of the specific early tasks assigned to the ARC are:

- To provide a standard simulation and process construction language to facilitate timely and responsive assembly of test drivers and simulation processes.
- Provide the simulation for analysis of computing systems used to interactively test candidate systems.
- Provide a generic real-time software process for evaluation of candidate computers and specific BMD algorithms.
- Provide an ever increasingly comprehensive SETS (System, Environment, and Threat Simulation) to operate in real-time, interfacing with candidate BMD data processing systems.
- Provide data link interface software, on-line monitor software, data recording software, and post-process and analysis software to facilitate data processing system analysis for ballistic missile defense.
- Provide an integrated facility for easily constructing specific simulations or tests using the components (hardware or software) provided.
- Provide data link facilities for BMD contractor support and for candidate hardware testing.

One of the most interesting roles that ARC performs is that of a testbed for BMD data processing hardware. Simulations available at ARC are used to react in real-time to candidate computer hardware which is implementing BMD functions.

Developed by ABMDA is a simulation of attack threats, the environment, interceptors, and a real radar, HAPDAR, which is located at White Sands (N. Mex.) Missile Range.

With various threats, this simulation is run on the ARC computer at Huntsville, and is connected by data link to the HAPDAR computer, which responds as if it were actually controlling the HAPDAR radar.

Software is developed and tested in this manner prior to the computer actually controlling the HAPDAR radar in live tests. After the live tests, the live and simulated results are compared to refine and validate both the simulation and the candidate software.

Expected to be one of the most significant events at the ARC will be the testing of advanced computers together with their corresponding software. The first advanced fourth-generation candidate computer tested physically at ARC will be the Texas Instruments Advanced Scientific Computer (ASC). This has a vector architecture and is substantially different from the high-speed, third-generation sequential machines currently available, such as the CDC 7600 or the IBM 360/195.

Vector (also known as pipeline) architecture shows promise in providing much greater real-time throughput for BMD type problems than is available today.

By July 1973, an ASC will be physically located adjacent to the current ARC CDC 7600 computer. The System, Environment, and Threat Simulation (SETS) will be run on the CDC 7600 to represent the real world (friendly and hostile) outside the BMD computer.

On an adjacent Texas Instruments ASC will be the candidate BMD software currently under development for this computer system.

The two computers will be physically interfaced so that dynamic interactive testing can be accomplished. BMD software and developmental methodology and techniques will continue to be advanced as the candidate hardware is tested for performance in a BMD environment.

The ASC will be only the first of what is expected to be many advanced computers that will be tested in the ARC in the future. Plans for the development and installation of a Parallel Element Processing Ensemble (PEPE) computer system are well under way.

A new digital data processing machine, PEPE employs parallel and associative techniques to augment conventional computers in providing improved performance and cost-effectiveness in ballistic missile defense service.

Because a large part of the BMD data processing is characterized by high parallelism, along with extensive attribute searching and grouping operations, PEPE functions with remarkable efficiency, and is nearing completion of a 4-year R&D effort. The first three years consisted of a feasibility and demonstration phase.

During the past year an improved design for competitive hardware procurement of an MSI/LSI PEPE computer system has been completed. A prototype PEPE is expected to be delivered and installed in the ABMDA Research Center for evaluation and testing by July 1974.

Establishment of the ABMDA Research Center is considered to be one of the major milestones along the path of advanced ballistic missile defense R&D. Standard methodologies for development of large complex software systems and their specific applications to BMD are expected to accelerate greatly as an ever-increasing stream of scientists and engineers apply their talents in the center.

Ballistic missiles hurtling toward key targets in the Continental United States—if that dreaded possibility ever should materialize—will find that intercept-and-destroy technology developed with the aid of ABMDA Research Center resources, is equal to the task of national defense.

MERDC Takes Over Management Duties of CCL

Transfer of responsibility for management of the U.S. Army Coating and Chemical Laboratory to the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va., was assumed in mid-October by the U.S. Army Materiel Command. The CCL will continue to operate, as it has since it moved from Fort Holabird in 1943, at Aberdeen (Md.) Proving Ground.

With this change, the CCL brings to MERDC control the mission of a Lead Laboratory (Army-wide) for mobile equipment air pollution control, and for total management of the Army Materiel Command program in fuels, lubricants, hydraulic fluids and preservatives.

The CCL work program is oriented toward materials, rather than hardware or systems, that will improve the protection of military equipment from adverse environmental elements, improve its operational efficiency and prolong its service life. The CCL also is responsible for developing, writing, and updating military and federal specifications for materials within the confines of its mission.

Organizationally, the CCL will become the fifth MERDC technical department under command of COL Bennett L. Lewis. The CCL will operate on a par with the current Countermine/Counter Intrusion, Electrotechnology, Mechanical Technology, and Military Technology departments. Harry L. Ammlung will continue as CCL director with no change in his staff of five military and 43 civilian personnel, including 26 scientists.

A subactivity of the CCL, the U.S. Army Fuels and Lubricants Laboratory at San Antonio, Tex., is included in the in-place transfer.

Transfer of the CCL to the MERDC is in consonance with over-all realignment plans of HQ AMC, toward the goal of optimum utilization and conservation of total manpower resources.

CCL personnel take pride in a notable record of fast-reaction capability in the laboratory's areas of expertise. One of its most recent developments is an efficient biodegradable cleaner. The trend toward making military equipment lighter and stronger, using aluminum, magnesium and plastics, generated an urgent need for a cleaner that was noncorrosive. Still it had to be efficient enough to permit cleaning of metal parts in contact with plastics.

Other recent CCL accomplishments include an antifreeze corrosion test kit, a single packaged antifreeze for water-cooled military automotive equipment, fast drying enamels for ammunition, improved coating formulations to meet air pollution standards, and a low-temperature fluidity test for gear oils.

The CCL was a part of Development and Proof Service, Aberdeen, until it was established as a separate laboratory in 1956. Under the 1962 Department of the Army reorganization, it was designated an independent laboratory and given the mission, within its area of interest, of supporting the entire AMC complex. In 1968 it became a division of the then newly established Aberdeen Research and Development Center.

NSIA Symposium . . .

GEN Miley Informs Industry About Results In In-house Labs, CAD-E, Materiel Policies

GEN Henry A. Miley Jr.

In an address to a National Security Industrial Association Symposium in Washington, D.C., GEN Henry A. Miley Jr., CG of the U.S. Army Materiel Command, discussed in-house laboratory achievements, the Computer Aided Design and Engineering (CAD-E) Program, and changes in materiel procurement policies, as follows:

* * *

You will note that the agenda for our symposium lists the Joint Logistics Commanders as the last three speakers on the agenda.

This arrangement strikes me as being appropriate to the occasion, even though being last is not in keeping with the traditions of the United States Army.

On the other hand, I am reminded of the passage from the Gospel according to St. John which says, "Every man at the beginning sets forth good wine—and when men have well drunk, then that which is worse, but thou hast kept the good wine until now."

At lunch, yesterday, our keynoter, Secretary [Deputy Secretary of Defense] Rush, eloquently and succinctly stated the problem. Other speakers and panel discussions have dissected the problem and its ramifications from the viewpoints of the Office, Secretary of Defense and the private sector.

It follows, logically then, that the three Logistics Commanders, responsible for the management of the development and procurement establishments of the uniformed services, close out the agenda with the operational viewpoint.

I feel fortunate to be the first of the Logistics Commanders to address you. I say this because as all of you appreciate the Defense Department's program to reduce and control the cost of its weapons systems has certain universal aspects and this universality makes a second and third speech a difficult chore—if one is to avoid the Me-Too Syndrome.

I will try, therefore, in the next few minutes to be as specific as possible, to talk about Army things, and hopefully, thereby, leave plenty of room for my two counterparts representing the junior services.

My subject, according to the agenda, suggests that we in the Army have been experimenting and will continue to experiment in "Attacking Cost." I like the connotations of that word, "Attack," because the contemporary image of military people in my business is one of total defense against the slings and arrows labelled "mismanagement of weapons systems acquisition."

It is a fact of life that our modern weapons systems are costly: they are costly to develop, costly to produce, costly to operate, and costly to maintain in the field. The word "costly" has become a loaded word. As now used in public forum, it has become synonymous with too expensive. I choose not to explore the emotional twilight zone of cost effectiveness.

In any case, we in the Army, have launched and are pressing an attack on a broad front in an effort to reduce the cost of our weapons systems, the cost to develop them, the cost to produce them, and the cost of supporting them in the field.

From this broad-based attack, I have selected a few specifics which, hopefully, will project the range and depth of our effort.

I shall begin at the front of the development cycle—the technological base. The Army operates a variety of laboratories which, when coupled with their companion laboratories in industry and the academic world, constitute the breeding ground for fundamental new concepts, concepts as to new things as well as new techniques. We look to this breeding ground for lower cost materials, more durable materials, simpler and more reliable devices, lower cost techniques of fabrication and integration.

Here are a few current products of our Army laboratories which will lower the cost of the material.

Our laboratory research on the fundamental chemistry of explosives showed small amounts of potassium nitrate substituted for ammonium nitrate stabilized the explosive and allowed long-term storage of the material MINOL, the explosive used in bombs.

Not only did we get an improved material, but it was cheaper to produce, with cost savings of about five cents a pound for a total of $9.3 million during FY 1972.

Research on the plasticity and toughness of metals for gun barrels has resulted in longer cannon life. The improvement of these characteristics necessitated a quicker and cheaper way to test them. Knowledge of metal behavior and fluid dynamics allowed development of a dynamic hydraulic simulation to test cannon tubes for fatigue, saving expensive field firing. This program is expected to be used to test the XM198 tube for the 155mm towed howitzer, at savings of $3.5 million.

Analyses and research on electronic logic systems, components, and electronic laminates have produced a technology on laminated component systems which allows the design of a fuze for fully automated production at a high volume rate. The net result is not only a better quality controlled fuze, but enormous dollar savings as well.

For example, a mortar fuze normally costing $20–$30 can be produced for less than $10 with production in the millions of units.

I could dwell on our laboratory achievements in cost reduction for a considerable period of time, but at this point I will leave basic technology and move to the development phase. Here we are experimenting with a variety of ideas to control and reduce both the cost of developing as well as the time to develop our systems.

Let me talk under this heading of what we consider to be the best horse in the cost-reduction stable. It goes by the name of CAD-E (Computer Aided Design and Engineering), the application of the computer to the design and engineering of components and, ultimately, complete end items.

Historically, we have designed and engineered our hardware by the cut-and-try method—make one or two, test them until they fail, design and fabricate fixes, test and fabricate another batch, test again, and hopefully arrive at a design which comes close to the original requirement, a lengthy and costly procedure.

About two years ago in the Army Materiel Command, we launched an intensive CAD-E program. We set up a CAD-E council, chaired by a general officer in my headquarters. At each subordinate command concerned with Weapons Systems Development, we established a CAD-E organization. We set up in-house training courses in CAD-E techniques and a course for our young people at the University of Michigan which grants a master's degree in CAD-E. To date we have trained over

1,200 CAD-E practitioneers in-house—and have 17 students at the Michigan course.

Then, because I am a Show Me guy, I required each developing element of the command to execute a CAD-E hardware project in-house. The principle here is that if we can do it in in-house laboratories, we can stimulate industry to follow suit and lend a practiced, helping hand.

Two weeks ago we held a Show and Tell Conference out at Rock Island, at which each of our laboratories and developing agencies reported on their in-house projects. The results were heartening and I have selected one of these to talk about in some detail.

The Army has under development new lightweight 155mm and 105mm howitzers. The latter incorporates what is known as the soft-recoil principle. In layman's language, soft recoil is achieved by pulling the lanyard while the gun tube is moving forward.

The effect, of course, is that the length and force of the rearward motion after firing are significantly reduced, with all sorts of good results on size and weight of the carriage and effect on the crew.

We have designed the recoil mechanisms for these two artillery pieces in-house, using the computer. How much did we save, as compared to the sequential prototype method? In time, probably 15 months; in dollars, something on the order of $15 million.

At the end of the Show and Tell session at Rock Island, I asked my cohorts how CAD-E is catching on with our contractors. Their answer was "Very spotty." This depressed me, but a couple of days later the president of one of our helicopter producers told me that his company had used CAD-E for the complete system design of their candidate for one of our on-going competitions. My spirits rose again.

Recently, I spent a day at the U.S. Military Academy with a group of my senior military and civilian people who were completing a week-long CAD-E seminar conducted by the faculty. I learned that our cadets, during their engineering courses, are acquiring more than just a passing familiarity with the computer and its application in the design and development world. My hopes for the future received another lift.

I will stop talking about CAD-E and move on to other subjects, but I honestly believe that if we are truly serious about reducing the cost and time involved in the development phase, the computer offers our single best hope.

Let me turn from the development phase of the acquisition process to procurement and production. Under the heading of procurement, we have explored a host of avenues leading to reduced cost and better cost control. Some of them are completely familiar to this audience.

An example is, Should Cost Studies and the cost and performance data generated by contractor management systems after validation in accordance with CSCS criteria established by DoD Directive 7000.2. Our Should Cost and CSCSC criteria efforts are bearing fruit—even though the enthusiasm for them among our contractors has been somewhat less than hysterical.

But no matter how much we debate the issue—pro and con—the fact remains that competition is still the greatest spur to cost control and reduction. It is also a historical fact of life that, in general, we have tended, once the development contractor has been selected and, particularly in the case of sophisticated systems, to complete the development and production phases without further competition.

We have been exploring techniques by which we might extend the force of competition beyond the selection of the developing contractor. The Competitive Prototype Approach coupled with Production Cost Targets appears to offer some hope.

Recently, we awarded contracts for competitive prototypes of our new Scout Vehicle and soon will plan to award similar contracts for the Utility Tactical Transport Aircraft System (UTTAS). In both cases, we have included unit production cost targets and—during the selection process—we make an evaluation of the contractor's design against the target.

At the end of shoot-off or fly-off of the competing prototypes, we will select one contractor for complete development and initiate production. Prior to this selection, we will solicit price proposals for first production. These prices, together with other factors, will form the basis for selection.

In these two cases, and in others which I won't discuss, we will effectively extend the pressure of competitive price at least into first production.

A few months ago we awarded a multiyear contract for engineering development of our next air defense missile system. This contract was awarded noncompetitively to the company which has been the developer and producer of our earlier and current air defense systems.

In the arrangement with the contractor, we have included the whole array of cost control and cost reduction features, plus a new one which I will discuss in some detail. The contract, which is a cost-reimbursable type, was negotiated and awarded on the basis of Should-Cost Type Review. The contract requires cost and performance reporting as contemplated by DoD Directive 7000.2.

The contract contains product cost targets, at both the system and major subsystem level. The contract has two incentive features. One is a straightforward incentive for management and performance. Seventy-five percent of the award fee is payable incrementally, based on contractor performance as evaluated subjectively by the government.

The final 25 percent of this award fee is payable at the end of the development phase, when production prices are quoted by the contractor and compared by the government to the previously agreed upon production cost targets.

Now for the new feature. Shortly after the award of the engineering development contract, the government made an award to another contractor whom we call the SECRAC. SECRAC stands for System Engineering Cost Reduction Assistance Contractor.

This SECRAC, who works directly for the project manager, was selected from those contractors with a good background in development and production in the electronics-computer field. His job is to assist the project manager during development in controlling and reducing costs.

You can imagine that the prime contractor did not greet the SECRAC idea with warmth and joy. However, the SECRAC is now in business. The project manager is pleased with the results to date, and reasonable harmony appears to exist between the prime and the SECRAC.

Among the SECRAC's tasks are: first, developing independently a list of system parameters and design requirements which are most cost-sensitive; and, second, assisting the PM in reviewing the more important production unit costs.

It will be interesting to watch the SECRAC at work and to assess the value of this approach. What we are doing, of course, is applying the experience of two contractors, the prime and the SECRAC, to the fundamental problem, again, of controlling and, hopefully, reducing procurement costs.

I have talked about our attack on costs in the technology area during the development phase and from the viewpoint of procurement techniques. Let me talk very briefly about reliability.

Even though we concern ourselves mightily about the investment costs of our weapons systems, the fact is that the 10- or 15-year operating and maintenance cost in the case of most weapons systems far exceeds the investment costs.

How can we attack this cost area? Obviously, by increasing the reliability of our systems, thereby increasing availa-

(Continued on page 30)

NSIA Symposium . . .

GEN Miley Informs Industry About Results In In-house Labs, CAD-E, Materiel Policies

(Continued from page 29)

bility. We will need fewer numbers if the items are available more of the time and, reducing maintenance costs, they won't break down so often.

We put our reliability attack under two headings:

First is our continuing assessment and reassessment of equipment already in production or in the hands of troops. We identify the components and subsystems which have less than desired reliability. If life cycle analysis supports it, we redesign for greater reliability and retrofit or replace at wear-out time.

Under this program we have achieved some very satisfying results. An example is the AH-1G attack helicopter, commonly known as the Cobra.

The bearings on this bird's main rotor hub were giving us a service life of about 300 hours. We designed and are now installing at wear-out time elastomeric bearings which give a service life of 2,500 hours and require no lubrication. We are also replacing the bearings on the Huey with elastomeric bearings. We estimate a life-cycle cost savings of over $110 million for these birds.

On the ground we have been doing the same sort of thing for the good old, high-density, ¼-ton truck, often called by the layman, the jeep. We are now delivering the fourth production model of this vehicle. The first model had a Mean Time Between Failures of 1,023 miles. After 90,000 miles of testing, the fourth production models have demonstrated 4,500 Mean Miles Between Failures—an increase of over 400 percent.

But the real pay-off in reliability, as we all know, is designing it into the system during development. We have finally convinced ourselves, our project managers, and engineers, that even though increased reliability will occur automatically—as we move through development into production—we can make it increase. It can increase at a greater rate if, for each new system, we develop a reliability growth plan with dollars to support it, and milestones to measure its progress.

So, for each new weapons system on which we initiated development during Fiscal Year 1972, we wrote into the specification and contract, details which are necessary to insure reliability growth.

Before I sit down, allow me to depart from my theme and address a subject which made its appearance, indirectly, during yesterday's sessions. This subject has to do with trade-off proposals by contractors and authority of the project managers.

During the past year, the technical specifications for our new systems have contained what we have termed "bands of performance." That is, we have not specified the desired speed of the new system at 150 knots or the weight at 20,000 pounds, but instead we have used bands—140 to 165 knots, or 18,000 to 21,000 pounds.

Our objective in using these bands was to elicit from the contractors proposed alternative designs which would trade-off performance within the bands for a reduction in unit cost. In the past two months, I have talked to representatives of seven contractors who competed for development contracts in which performance bands were used.

My sample is small but my initial evaluation is that the contractors didn't understand what we were up to. Most of them felt that to offer a design close to the lower limits of the bands, even though it would cost less in production, would lose them brownie points in the selection process.

I hope that my impressions are wrong and that real trade-off considerations took place. These same contractor representatives questioned whether the project manager had the authority to trade-off performance. I assured them that the project manager had full authority to trade-off within the bands. I don't think they believed me.

I am sure that we have a long way to go to convince our contractors that we are in deadly earnest about trade-offs, and that our project managers have full trade-off authority.

The other day I was reading a book, or manual really, prepared by the British Royal Military College of Science. The manual is used for background reading by students at the college. The British Weapons System acquisition structure and procedures differ in many respects from ours, but their basic problem appears to be the same. I found a definition which is interesting and illuminating.

Effective Equipment, according to the Royal Military College, may be defined as "what the user wants, needs, and can get."

I believe that the job facing the military services and industry in the years ahead is to see to it that what the user says he wants and can truly demonstrate that he needs—we can get for him.

Armed Forces Offering Medical Scholarships

Under a new Army Health Professions Scholarship Program, linked to the legislation signed by President Nixon to create a Medical College of the Armed Forces, up to 5,000 health scholarships will be offered in return for military service.

While the medical school is still several years away from becoming an operational agency, the scholarship program is being implemented by regulations effective this academic year. Scholarships will be open to students of medicine, osteopathy, dentistry, veterinary medicine and the allied medical sciences.

A student selected for participation will be commissioned a second lieutenant in the Army Reserve. While in school, he will remain on inactive status receiving a $400 per month stipend plus tuition and some other academic expenses.

If his academic schedule permits, the student will perform 45 days of yearly clinical or professional training as an officer in an Army facility. In any case, the student will be paid a second lieutenant's salary for 45 days per year—his pay totaling about $5,300 annually.

The student serves one year of commissioned active duty for each year of support received, with the minimum obligation being two years.

An applicant must be 28 years old or younger, meet other requirements for an officer's commission and be sincerely motivated toward military service in his profession. Inquiries should be sent to: The Surgeon General, DASG-PTP-D, Attn: MAJ Vance, Washington, D.C. 20314.

Army Publishes Proceedings Of Operations Research Meet

Proceedings of the 11th annual U.S. Army Operations Research Symposium have been published in a 293-page document distributed recently to participants.

Sponsored by the Office of the Chief of Research and Development, the symposium was hosted and conducted by the U.S. Army Research Office—Durham (ARO-D), N.C. About 225 operations research specialists representative of the Department of Defense, Department of the Army, academic institutions and industry participated.

Approved for public release, the proceedings report on all contributed papers and major addresses presented at the symposium.

In the foreword, ARO-D Commander COL Lothrop Mittenthal refers to the new aspects of this year's program—expository tutorial seminars on "Risk Analysis" methodology, panel sessions, and a considerable amount of audience participation.

Copies of "Proceedings, Eleventh Annual U.S. Army Operations Research Symposium" are available from the Defense Documentation Center, Cameron Station, Va. 22314.

Labor Costs to Increase DoD Budget

Department of Defense (DoD) personnel costs will double in the 1973 budget from the $21 billion needed in 1965, despite a reduction of 300,000 men and women in the military services.

"Our labor costs are going up," Secretary of Defense Melvin R. Laird recently told newsmen at San Clemente, Calif. He said that in the 1973 budget the total personnel-associated cost is $42 billion for 300,000 less people.

"We have had the greatest cost growth in the DoD in personnel costs," he said, and noted that DoD will continue to have increases in this area.

SPEAKING ON . . .

Future missile R&D, objectives in 'Big 5' materiel progress

(Continued from inside front cover)

involved in achieving these systems, both in terms of R&D and production.

Talking first about the shortening of the elapsed time, the Army has recently established some new basic policies for the development of its weapon systems. Army Regulation 1000.1 points to the following changes and areas requiring attention.

The first is a shortening of the requirements generation process. To avoid long staffing of requirements, anyone in a responsible position in the Army can recommend, through the medium of a Required Operational Capability document, the need for a new capability. This will be a short document and, once accepted, requirements will be established through the use of a task force approach—in industry they are called preliminary design teams.

The task force will investigate the various alternatives available to satisfy the required operational capability, possibly in the course of the study also utilizing industrial contracting to aid the task force. The output of such a task force will be a system development plan and a justification for the selected alternative.

Certain fundamental requirements, considering the over-all costs that these requirements involve, will be established. These major requirements will be expressed as bands of required performance and, together with a production unit cost goal for the system, will provide the basis for program management.

The program manager, by balancing through the course of development other requirements against production cost, will make certain that once the system is developed we can afford to buy it.

Having shortened the development process, our next area of concern was associated with the development time itself and the achievement of the required reliability in the development process. To shorten this time, we have streamlined our internal Army procedures to make certain that, from the time of the issuance of the Request for Proposal, an award can be made within six months.

The second advance is to insure, in the course of the development program, that adequate time and money are programed to perform significant component and subsystem environmental testing.

Experience shows that it takes somewhere between three and ten thousand hours of test time on a device—feeding back the test information to the design—to make certain that the desired Mean Time Between Failure is achieved.

When an item has passed the contractor test, the Army conducts its own development test and its own operational test in less than a 6-month period.

Our new face-to-face decision-making process, involving an Army Systems Acquisition Review Council made up of senior staff and secretariat personnel, can then be used to make a very rapid decision as to whether the system is essentially ready for low-rate production (LRP).

An LRP decision could be implemented expeditiously because we intend using R&D funds to begin the advanced production engineering process no later than the beginning of the development test and operational test—the old ET/EST test. During this period the necessary planning will have been accomplished to enable the proper use of low production funds. Those items would then be utilized for final operational testing and final development testing. Satisfactory completion of this testing, again within six months, would allow a full-production decision to be made, utilizing the same high-rate tooling upon which low-rate units had been produced.

A point to be made is that most of these time-saving activities involve actions by the Army and under the control of the Army. By speeding up that process of decision-making and Army actions, we hope to reduce significantly the time involved in our programs, without in any way increasing the risk involved in reaching the goal.

The next subject of common concern that I mentioned was that of the reduction of the cost of the items to equip the troops. Within the Army, there are a number of things we plan to do which affect industry in terms of things that they must also be knowledgeable of and able to accomplish.

The first concerns a proper cost estimating by the government of what a program is apt to cost. The use of parametric techniques will assist in making certain that too-optimistic costs are not used in the initial planning and budgeting of the system.

The second concerns utilization of "design to" production cost goals as part of the development process. We expect to establish, in addition to our performance goals, the cost goals that must be met in the production items if we are to be able to buy them and equip the troops in the right quantity.

By bucking these "design to" cost goals against the previously mentioned bands of performance, we hope to be able to achieve required performance within, however, the unit production costs established at the beginning of the program.

You are also aware of another step that we are taking to control properly our programs; that is the use of cost-reimbursable type contracts in development. This allows a proper interaction between the government program manager and the contractor program manager so that quick and meaningful decisions can be made in terms of balancing the performance and production cost goals that I just talked about. The flexibility of the cost-reimbursable type contract is essential to this type of team work.

We have tried on one of our major systems, the SAM-D, and will perhaps on others as occasion warrants, three other ways of controlling the production cost. The first is to utilize an assistance contractor to our program manager, but to focus his major activities upon cost reduction in production rather than upon the technical problems of development.

This system engineering cost-reduction assistance contractor is working on SAM-D and we will evaluate the feasibility of such an arrangement on future systems.

Secondly, on SAM-D, we instituted what is called a Requirements Control Board, consisting of very high-level secretariat and military staff people. It was our conviction that many of the cost increases in the development and production areas of past programs were associated with the insertion of tougher requirements, and the interruption of the flow of the development program by new requirements.

Our hope was that by instituting a rather high-level "valve" on such requirements we could prevent such growth. Secondly, this is a good technique for examining proposed reductions in requirements that might allow significant cost savings; also, achievement of quick decisions will enable a development program to proceed along the new balanced approach.

We have some experience with this policy and have found it has been most effective in controlling requirements and getting quick decisions for reduced requirements on SAM-D.

In addition to award-fee provisions in the development contract, which depend on whether the development program has met the production unit cost goals, we have instituted one additional contractual approach. This is agreement on the fee swing to be allowed on the production contract as a function of whether in those contracts the original production cost goals were met. We would expect that the costs of the initial production would clearly have to be paid, depending upon how the program has come out. But we would also expect that the fee to be earned on the hardware and the rest of the system should be a function of whether the cost goals have been met or not.

In conclusion, I hope that you have gotten a feel for some of our general-purpose programs and the increasing importance of Terminal Homing in Army programs—particularly, HELLFIRE, Lance, Pershing, Stinger. I hope that you have also gotten the impression of a dynamic ballistic missile defense program that must continue to go along in this country and will, for some period, have a very heavy emphasis on technology improvement.

More importantly, I hope you appreciate the importance of the two common concerns that I mentioned: that of reducing the time involved in getting Army equipment into the field; and reducing the cost in production of that equipment.

Environmental Control Units . . .

MERDC Investigates Performance of Improved Cooling Units With 'Holdover' Capability During Period of Power Failure

By Oscar Oldberg

As the Army continues developmental efforts to achieve the ideal electrical power sources for specific requirements, consideration is being given to uninterrupted availability units for communications and electronics systems. These include battery-energized systems for temporary holdover in case of emergency servicing or other interruptions.

Any gain possible in reduction of total power requirements during this period is obviously an improvement in system operation. Since military environmental control units (ECUs) are often a large percentage of electrical loads, a unit with holdover capability using no significant power during a "down" generator period contributes substantially to the ideal of continuous power maintainability.

The Environmental Equipment Division of U.S. Army Mobility Equipment Research and Development Center (MERDC) has been investigating methods and eutectic materials that will provide a "holdover" capability to military air conditioners.

Several heat exchanger types and cooling storage materials have been analyzed, and laboratory tests conducted with two promising types to determine the performance characteristics and the direction of R&D that would be indicated.

A direct type of holdover cooling unit is shown in Figure 1, operating in the cooled air discharge of an ECU. At normal operating temperatures the eutectic materials in the tubes are cooled below their fusion temperature and become partially solid. If the air discharge temperature rises due to insufficient cooling by the refrigerant evaporator, the warmer air raises the holdover material temperature, absorbing the heat of fusion to cool the air passing over the tubes.

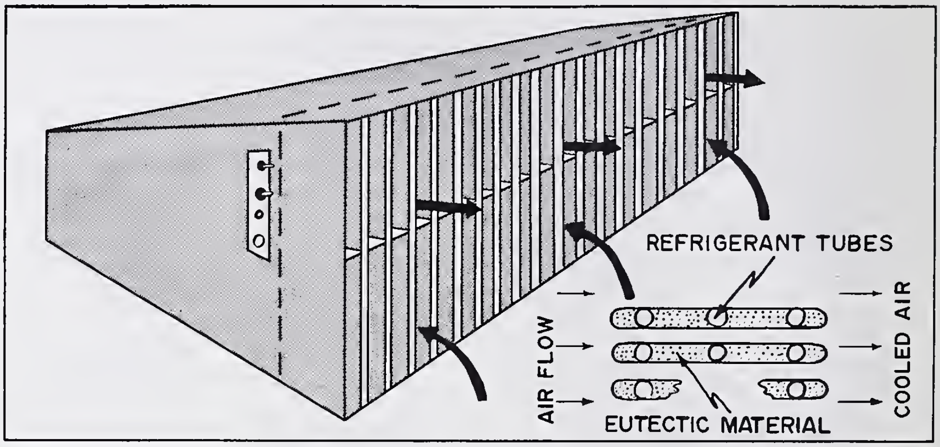


Fig. 2. ECU With Eutectic Holdover Coil.

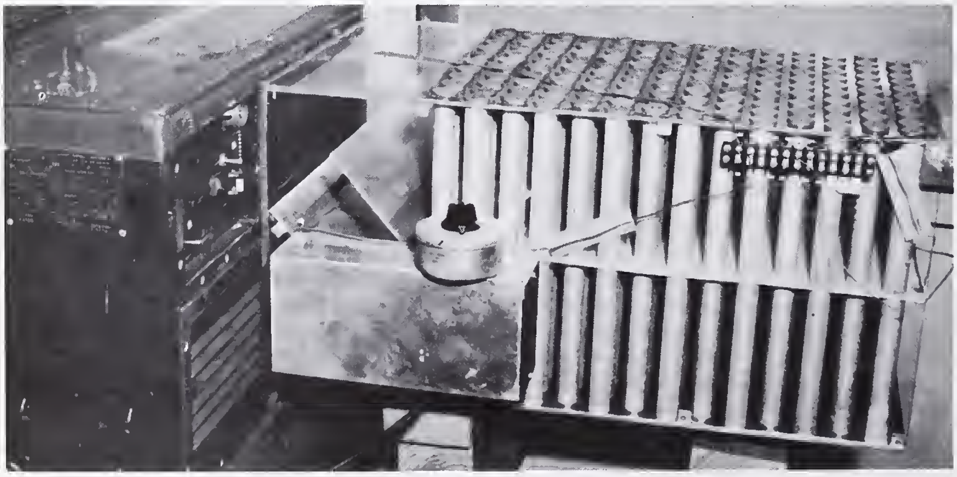


Fig. 1. Eutectic Heat Exchanger Coupled to Air Conditioner.

Figure 2 shows a holdover concept with the heat exchanger replacing the ECU evaporator coil, permitting a considerable over-all space saving.

The cross section through the eutectic charged plates shows the means of heat transfer from the air to eutectic material and to the refrigerant tubes. The transition temperature is critical and is set at a point between the operating refrigerant temperature and the return air temperature to the ECU.

During normal operation, the refrigerant cools the holdover material below its fusion temperature and by conduction maintains the plate surfaces at the proper level to cool the air. Should a temporary loss of refrigerant cooling occur, the holdover material takes over, supplying cooling by melting and absorbing the heat of fusion. Fan air propulsion is still required which will draw a small amount of electric power from the reserve source.

Possible cooling storage materials were researched with the objective of seeking maximum heat of fusion, proper transition or fusion temperature and reasonable cost. A list of 10 potential formulations was developed and two of the most promising were calorimeter tested for evaluation of the desired characteristics. A hydrate of sodium sulphate, sodium chloride, and ammonium chloride shows the most effectiveness in the work to date.

Future development of eutectic storage materials, it has been estimated, may produce a heat of fusion value over 100 Btu compared to approximately 70 for materials investigated in this project. The future improvement in storage materials will add proportionately to the attractiveness of this operating concept.

Analyses were made of the various factors influencing performance of the holdover plate heat exchanger. Plate thickness and spacing dimensions were related to heat-transfer and flow-resistance values making use of Reynolds number analyses. Results were obtained for conditions existing with a typical military air conditioner to provide optimum performance.

Practical considerations were also injected, such as setting refrigerant tubes at ¼-inch diameter minimum, which was felt to be the smallest standard size capable of satisfactory oil return in the circuit.

A series of investigational tests con-

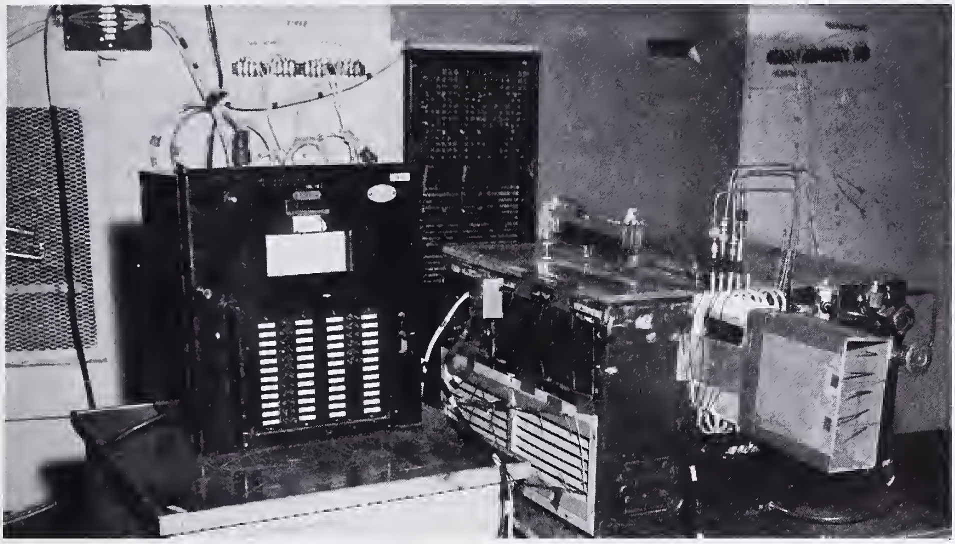


Fig. 3. Refrigerant and Airflow Circuits.

ducted in a controlled ambient temperature in the Air Conditioning Laboratory at MERDC used sectional modules of the holdover heat-exchanger construction. These were set up with refrigerant and airflow circuits as shown in Figure 3 and instrumented to obtain flow, temperature and resistance data.

A mixing box at the heat exchanger outlet provided uniform air temperature and velocity distribution to improve the accuracy of average observed values and corresponding cooling capacities.

The performance curve obtained from these tests for optimum plate spacing is shown in Figure 4. This represents the present output, which would be improved with future advancement in eutectic materials.

Test results indicate that the holdover heat exchanger is effective when adequately fitted to the evaporator circuit of a military ECU, and provided with proper temperature controls, to complement the uninterrupted electrical power equipment for electronic systems.

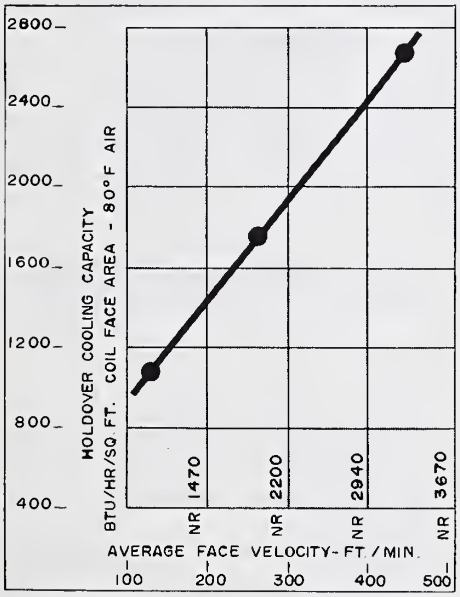


Fig. 4. Holdover Cooling vs Airflow. (Performance Data From Test Section)

OSCAR OLDBERG is an engineer in the Environmental Equipment Division, Mechanical Technology Department, U.S. Army Mobility Equipment Research and Development Center (MERDC), Fort Belvoir, Va.

A native of Ithaca, N.Y., Oldberg received a degree in mechanical engineering from Cornell University in 1933. He was employed in engineering development, research and management activities in the automotive and refrigeration and air conditioning industries prior to joining MERDC in 1961. Since joining the R&D Center, he has received two patents for inventions.

NBS Updates Programing With New Documentation

OMNITAB II, a simplified computer programing system developed by the National Bureau of Standards (NBS), is now available for public use.

User-oriented for a large computer, the system is designed to simplify operation while increasing accuracy and effectiveness, particularly for non-programer personnel.

The program is contained on magnetic tape, with complete documentation in four publications, at a cost of $2.50. Developed in 1963, the system was revised in 1966 in response to computer changes. Version 5 of OMNITAB II is the latest improvement.

Efficiency of the system arises from its two main attributes—a simple English vocabulary of over 250 words, and a large operator pool that invokes a complex sequence of operations requiring dozens of lines of a code in other programing languages. Problem solving is achieved in a virtually machine-independent manner.

Early interest in OMNITAB by a number of universities abroad has stimulated the development of vocabularies and associated pharses in languages other than English. OMNITAB II vocabularies now exist in Dutch, Italian, Danish and Slovene.

HumRRO Paper Summarizes Battlefield Detection Test

Factors that determine the adequacy or inadequacy of the infantryman's detection performance in a battlefield situation are summarized in the Human Resources Research Organization (HumRRO) Professional Paper 11-72.

Titled "Target Detection in the Field," the 4-page summary describes experiments conducted using 90 enlisted men who detected moving human targets in three different types of terrain.

Analysis showed that the negative exponential model did not adequately describe the men's detection behavior, but that target speed, target-to-observer range, and the terrain in which the target appeared significantly affected their detection time.

Copies are available from: HumRRO, 300 North Washington St., Alexandria, Va. 22314.

Data Evaluation Service at NBS

The National Bureau of Standards (NBS) has begun a new data evaluation service to improve the accuracy of pressure measurements for industry, scientific laboratories, and government agencies.

Worksheets and instructions may be requested from: Dr. P. L. Heydemann, A149 Metrology Building, NBS, Washington, D.C. 20234.

Transcalent Power Semiconductors

By Robert M. McKechnie

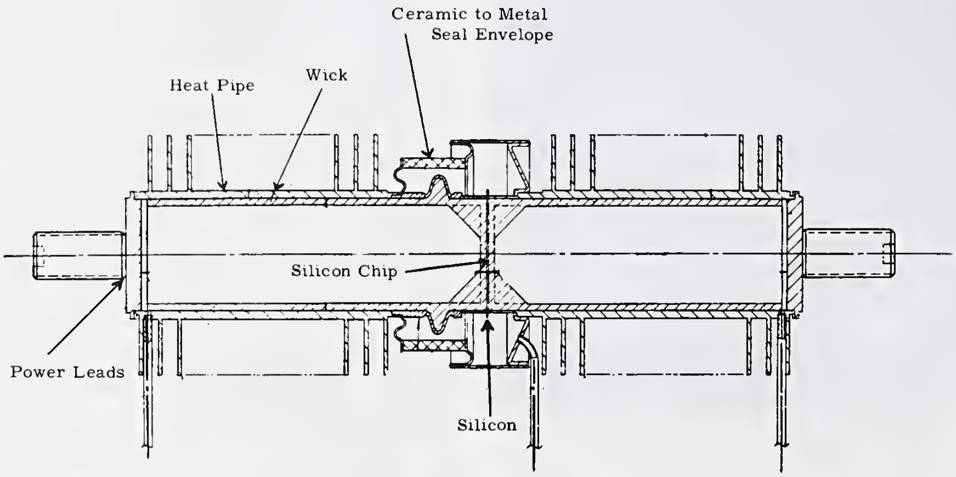


Fig. 1. Cross-section of Transcalent Rectifier.

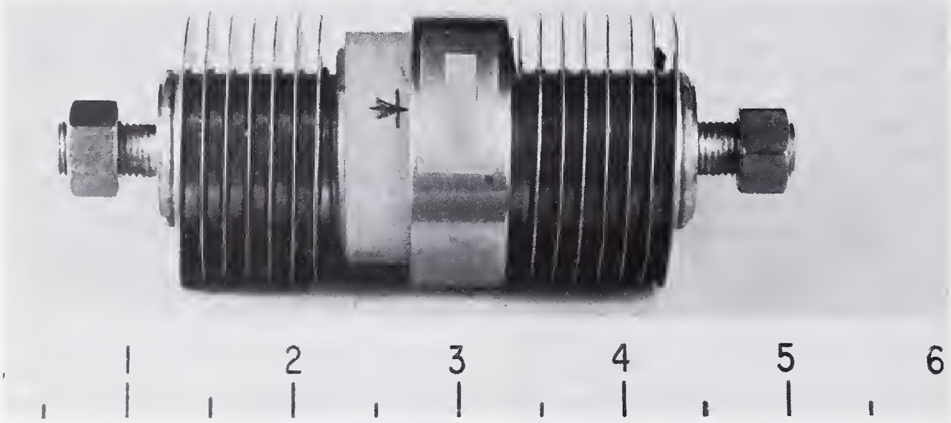


Fig. 2. Transcalent Rectifier Prototype 2.

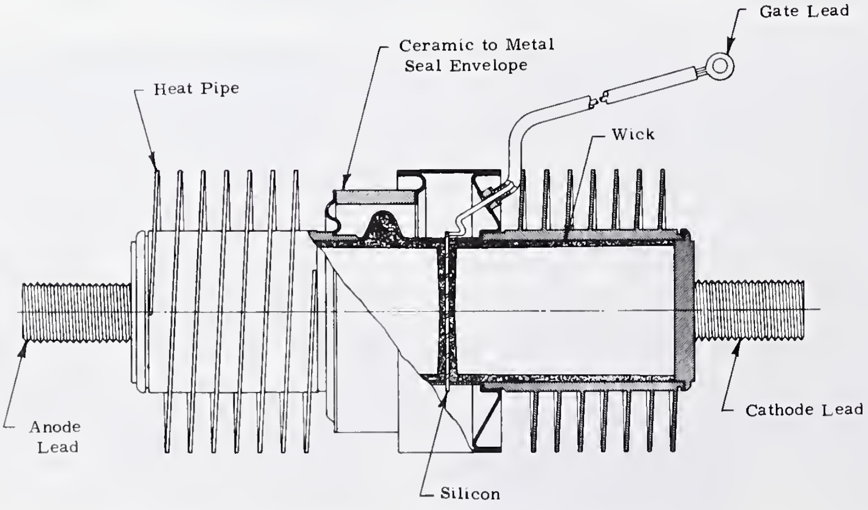


Fig. 3. Cross-section of Transcalent Thyristor.

One of the major problems with power semiconductor devices is that of heat rejection and the methods used for aiding the heat rejection. The U.S. Army Mobility Equipment Research & Development Center (MERDC), Fort Belvoir, Va., has started a developmental program to make use of heat pipe techniques as a method of attaining the desired rejection.

This program, under the Electrical Equipment Division, Electrotechnology Department, involves a major departure from usual design procedures or concepts for application of heat sink devices. The heat pipe heat sink is an integral part of the transcalent power semiconductor, in direct contact with the semiconductor chip, and does not require any additional external heat sinks.

TABLE 1
Rectifier Electrical Characteristics

	Standard device	Transcalent device	
Characteristic	Typical value available	Contract goal	Obtained
Maximum average forward current	250a.	250a.	500a.
Maximum peak forward voltage drop	0.55–0.9v.	0.55–0.9v	<1.0v.
Maximum peak one cycle non-repetitive surge current	4500a.	4500a.	6500a.
Maximum I^2t non-repetitive	52000a². sec.	85000a². sec.	176077a². sec.
Maximum PIV	400v.	500v.	300v.–500v.
Operating frequency	60 Hz.	Up to 2000 Hz. at 250a.	2600 Hz.

TABLE 2
Comparison of Commercial 250-Amp. Rectifier With the Transcalent Rectifier

Paramter	1N3735	Transcalent rectifier
Length (in.)	6⅜	5
Diameter (in.)	1¼ Hex.	1⅞
Weight (lb.)	⅝	⅝
Heat sink required	WN-1541-6	None—part of the unit
Heat sink dimensions (in.)	6¼ × 6¼ × 6	
Heat sink weight (lb.)	3.8	
Weight of rectifier and heat sink (lb.)	4.4	.62
Space occupied by rectifier and heat sink in air duct (cu. in.)	234	14
Occupying space	6¼ × 6¼ × 6	2 × 2 × 3.44
Thermal impedances θ (°C./watt) Direct current		
Junction to case θ j-c	.18	.022*
Case to sink θ cθs	.10	Eliminated
Sink to ambient θ s-a at 45 cfm	.22	.21
Junction to ambient θ j-a 2000 Hz. 180° conduction angle	.50	.23*
Junction to ambient θ j-a	N/A	.33*
Junction temperature (°C.)	200	130
Reliability failure rate Failures per 1000 hrs. (%)	.45	.063

*Based on a $\Delta T_{j\text{-}c} = 5°C$.

This construction method places the heat pipe wick in direct contact with the heat-producing element, the semiconductor chip. This eliminates the usual causes of thermal impedance in standard semiconductor devices—namely, the interface areas between the semiconductor chip and its metallic mounting blocks, and the interface between the semiconductor device and external heat sink.

The heat pipe heat sink is a sintered copper cylindrical wick surrounded by a nickle-plated copper-fin structure with an evacuated center space. A heat pipe is mounted on each side of the chip. The wick contains a few drops of distilled water and operates on the heat-pipe principle.

Figure 1 is a diagram of the construction of the transcalent rectifier. The over-all program was originally structured in 1969. When implemented, it involved the development of three transcalent power semiconductor devices—a rectifier, a thyristor (SCR), and a transistor. These devices will allow the USAMERDC to develop lighter, less complex, and more reliable power-conditioning equipment.

Figure 2 is a photograph of the rectifier, developed first because it was the least complex and could demonstrate the design concepts with the highest probability of success.

The transcalent rectifier was designed as a 250-ampere device but, due to the excellent heat-rejection capabilities of this structural design, the unit passed tests at currents in excess of 500 amperes, including a life test.

In addition to the higher rating, this device is about four times smaller and lighter than a standard 250-ampere rectifier with an external heat sink. It also offers a 17-fold increase in reliability because the silicon temperature remains lower at 250 amperes under the same test conditions.

Table 1 is a comparison of design goals and achievements while Table 2 compares the standard 250 ampere device and the transcalent rectifier, development of which was completed in 1971. Results are available in reports on Contract DAAKO2-69-C-0609 with RCA, Lancaster, Pa. This work was also described in a paper presented to the 1971 Power Conditioning Specialists Conference.

Several 250-ampere transcalent rectifiers have been sucessfully operated at DC, 60 Hz, 400 Hz and 3,200 Hz. Six additional 250-ampere transcalent rectifiers have been purchased for use in a 250-ampere transformer rectifier unit, to provide actual circuit operating experience.

Due to the success of the transcalent rectifier program, development of a 400-ampere transcalent thyristor (SCR), diagramed in Figure 3, was started in 1971 and will be concluded this year. Physically, it is the same size and weight as the transcalent rectifier. RCA is the contractor for this phase on Contract DAAKO2-69-C-0609. When work is successfully completed, development of the third device, a transcalent transistor, is planned.

ROBERT M. McKECHNIE III is an electrical engineer in the Electrical Equipment Division, Electrotechnology Department, U.S. Army Mobility Equipment Research and Development Center (MERDC), Fort Belvoir, Va.

A native of Texas, he received a BS degree in electrical engineering from Texas A&M University in 1959, and took his master's from George Washington University in 1963. He is a member of the Institute of Electrical and Electronic Engineers.

McKechnie's military service included assignment to MERDC, where he accepted a civilian position following his release from active duty. His work at the center has earned him an Outstanding Performance Rating, and he also has received a Special Act and Service Award for authoring a technical paper.

AMMRC Studying New Artillery Shell Process

By Donald C. Buffum

Supervisory Physical Metallurgist
AMMRC, Watertown, Mass.

In the normal banding of relatively large artillery shells, such as the 6-inch 155mm, the rotating band is mechanically hot-pressed into a recessed area of the shell body. The function of the band is to seal the gases behind the shell, thus providing the pressure to propel the shell and to engage the rifling in the barrel to provide the proper spin to the shell for increased stability in flight.

The recessed area in the shell body, as currently manufactured, has a series of knurled ridges machined on the surface to improve the mechanical bond. Artillery experts at the Army Materials and Mechanics Research Center (AMMRC), Watertown, Mass., have long believed that if the bands could be attached to the shells by a welding or a brazing procedure, the wall thickness of the shell and the thickness of the band could be reduced.

The recessed area of the shell would no longer be needed, resulting in an over-all thinner shell wall, since the weakened recessed area could now be removed. Since the band would not have to fill the recessed area, in addition to sealing the shell to the tube wall, a thinner rotating band could also be used.

Research scientists at the Army Materials and Mechanics Research Center, intent on achieving these advantages, decided to look into the feasibility of brazing the rotating band onto the shell, using commercially available filler materials.

In analyzing the procedure, it was observed that the greatest problem would be presented by the differences in the thermal coefficients of expansion of the materials being joined. Steel and titanium used in the alloy being considered for the shell body component have similar thermal coefficients of expansion. However, the coefficient of the gilding metal used for the rotating band is approximately double that of the shell materials.

Consequently, as the components were heated up to the brazing temperature a relatively large space would develop between the band and the shell, thus breaking down the capillary flow necessary for a sound brazed bond.

A series of experiments resulted initially in complete failure or in bonds with strengths too weak to serve their purpose in operation. Then a procedure was developed which gave results showing great promise of success.

In this procedure, a fixture was designed that would prevent the rotating band from expanding during the brazing heating cycle, thus overcoming the effect of the large coefficient of expansion.

Additionally, by heating the shell from the inside, a thermal gradient was produced in the components to minimize differences in thermal expansion while brazing. The hottest portion was now confined to the inside shell and the coolest portion to the outside band. This difference in temperature caused the shell to expand approximately the same amount as the band.

In its present stage of development, the process appears highly feasible. Efforts are under way to improve the banding efficiency operation so that faster and more uniform control can be exercised. In preliminary tests, the 155mm shells have performed successfully under high pressure (Zone 8) firing conditions. Studies will continue at AMMRC and Picatinny Arsenal to optimize this technique.

APG Plans Acceptance Tests Of Public Alert Radio Station

Acceptance tests of the first of 12 planned low-frequency radio stations designed to warn the public of a nuclear attack or major peacetime disaster are scheduled at Aberdeen (Md.) Proving Ground early in 1973.

Conceived as part of the Decision Information Distribution System (DIDS), the experimental prototype station will be part of a planned network to augment the Defense Civil Preparedness Agency's (DCPA) existing national warning system.

Equipped with a 50,000-watt transmitter and a 700-foot antenna, the prototype station is expected to lead to a network of emergency information services to 50 million residents. Ten eastern seaboard states, from North Carolina to Connecticut will be affected.

The experimental facility will transmit a low-frequency signal to 500 local, county and state agencies in addition to national warning system points, providing greater speed, coverage and reliability than present systems. Successful operation will be a basis for approval for 11 similar facilities across the country.

If the Shoe Fits . . .

You can give thanks for benefits from Army R&D in addition to its primary responsibility of helping to defend the United States

By Ron Hoskins

3d U.S. Army, Fort McPherson, Ga.

If the shoes you are wearing fit your feet, you are among the millions who benefit daily from the continuing non-military contributions of the U.S. Army. It was, in fact, an Army officer, serving in the Quartermaster Corps during the Civil War, who invented boots made to fit the left and right feet, respectively (before that time boots were made to fit either foot).

IT'S THE NEW MODEL--ONE FOR THE LEFT, ONE FOR THE RIGHT.
??
WEBB
SUPPLY ROOM

Comfortable footwear, however, is only one of the Army's many relatively unrecognized contributions to such fields as industry, agriculture, and medicine.

As you read this, you man be enjoying a cup of instant coffee that tastes as good as the percolated variety—something made possible by a new process called "freeze drying," first developed by the Army's Quartermaster Corps.

Last night you perhaps slept on chicken-feathered bedding that felt more like expensive waterfowl down—the result of a new chemical treatment attributed to Army research, even in the Sears catalogue.

Before pouring that first cup of coffee, you probably used several Army-invented aerosol containers to spray your mouth, hair, or other portions of your anatomy. More than 500 products are now packed in "spray cans."

You may drive to work in a car equipped with low-profile tires, which were first developed by the Army Ordnance Corps for increased traction and which are now found on virtually all new automobiles.

When you arrive—whether at some industry, business, farm or medical facility—you will undoubtedly use several materials, products, and pieces of equipment without realizing that they were invented or improved by the professional research and development scientists, engineers and technicians of the U.S. Army.

If you work in the steel industry, you will measure the tensile strength of your product by use of a hydraulic testing machine developed at the U.S. Army Watertown (Mass.) Arsenal. X-rays will be used to examine foundry castings in a metallurgical advance discovered by the Army Ordnance Corps. Other steel workers will use Army-born innovations in such processes as ultrasonic welding and centrifugal casting.

Perhaps you are employed by an industry primarily involved with the manufacture and development of synthetic rubber products, which range from tires and toys to furniture and underwear. You have a job today because Army researchers invented "man-made rubber" during World War II when natural rubber resources from the Far East were cut off. Hundreds of civilian jobs have been created as a result of that Army discovery.

Maybe you work in an electronics industry which manufactures those miniature radios and TVs with tiny integrated circuits reproduced by a photolithographic process conceived by the Army Signal Corps. Speed-detection, remote control, and many other almost supernatural devices are produced here in the U.S. today—because of the Army's experiments with radar in the 1930s.

If you are a businessman or work in an office, you will see "empires" given to the control of computers. These "thinking machines" are constantly finding better methods of marketing and production, but they were not created by the businesses they serve. The first "electric brain" was invented by the Army Ordnance Corps to help solve the complex problems of the Army Ballistics Research Laboratories at Aberdeen (Md.) Proving Ground.

If you have chosen a farmer's life in preference to the bustle of the city, you are probably already aware to some extent of the Army's contributions to your life. Here in the Piedmont, your fields might be little more than dry ground if the Army Corps of Engineers had not built that nearby dam or reservoir. There are no natural reservoirs in the Piedmont.

You no longer need to fear the dreaded boll weevil that plagued your predecessors on the farm, since the Army Chemical Corps developed controls that have almost eradicated the pest. The well-known battlefield smokescreen has been adapted by Army chemists into the most effective crop dusting technique in use.

Chloropicrin, discovered in an Army laboratory, assists you in the control of bacteria, soil fungi and nematodes—as well as being an excellent fumigant for the control of rodents and insects in mills and grain storage bins.

If you are a doctor or nurse, you also know about the Army's nonmilitary advances. A list of the Army's medical "firsts" is amazing: first hospital in America—first American textbook on surgery—first American pharmacopoeia—first book on the physiology of digestion—first application of photomicrography to pathology—to name a few.

Army Surgeon Benjamin Waterhouse introduced smallpox vaccination into the United States, and MAJ Walter Reed solved the deadly mystery of the transmission of yellow fever by mosquitoes.

Army doctors and medical personnel used antiseptic techniques as early as 1883—a year before Lister's famous work. Even the well-known plaster-of-paris cast, used in the treatment of fractures, was invented by Army medics who saw the need for a better method of splinting.

There are too many medical advances to mention them all, but heart patients will be interested to learn that the Army's weapons specialists are responsible for that marvelous little machine which measures the flow of blood in veins and arteries. Originally, this device was designed as a "flowmeter" based on acoustics and electronics to measure the flow of coolant in atomic submarines.

Regardless of occupation, we all have benefited daily from the nonmilitary contributions of Army professionals. In the past, Army officers such as LTs Merriwether Lewis and William Clark, and John Fremont, by daring exploration mapped and opened the land west of the Mississippi.

In 1914, Army engineers opened the most important trade route of the century with the completion of the Panama Canal—a task that had seemed more a dream than a possibility.

In the 1960s, Army topographic experts provided the Apollo moon missions with detailed, accurate maps of moon landmarks. To the amazement of millions around the world, Apollo 12 reported that the craters were "just where they were supposed to be."

Professionals on the Army's team in every field are constantly working to discover new ways to make our world a safer and more comfortable place to live. Army doctors and scientists are experimenting to develop a method whereby laser beams can be used to neutralize cancer tumors.

Other medical experts are researching an electrical device which can produce a surgical level of anesthesia within three minutes and recovery in two minutes.

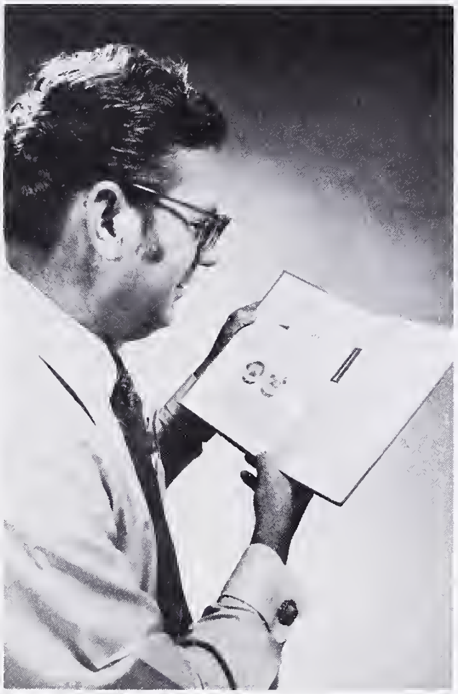
Army environmental specialists continue to promote ideas and provide manpower for ecological studies and projects—*but who knows what they'll come up with next!*

Translated Seven Years Later

Russian Version of Book Surprises WSMR Author

Dr. Willis L. Webb, a White Sands (N. Mex.) Missile Range scientist, was pleasantly surprised recently when two Russian language copies of a book he authored seven years ago arrived in the mail.

Although the title, "Structure of the Stratosphere and Mesosphere," looked strange to him in Russian, he was delighted to see his translated work. The book describes tests conducted at White Sands in the 1960s by the Meteorological Rocket Network.



Dr. Willis L. Webb

"They followed it right down the line," he commented. "They've done an excellent job of conveying what I tried to write. They put a lot of work into it."

Dr. Webb expressed pleasure at the fact that the Russian publisher printed his meteorological study in Moscow in 1969 as a hard-bound scholarly work.

When he heard rumors of the translation, Dr. Webb contacted his publisher and was informed that the United States has no copyright agreements with the USSR. Consequently, he got his first official notice from United Publishers of Moscow three years after the book was printed. N. Sabetsky, director of publications for the firm, noted in a letter to Dr. Webb that "the book was read by the Soviet people with great interest."

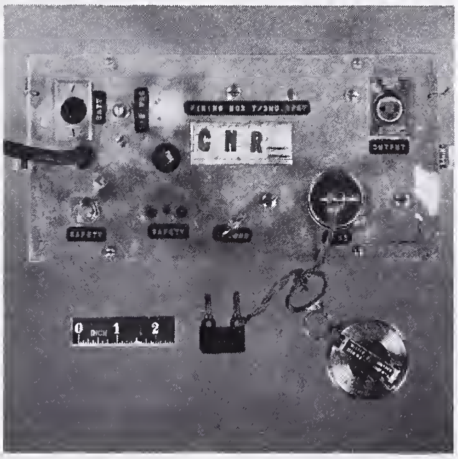
Dr. Webb is entitled to royalties on the Russian translation, but they can only be spent in the Soviet Union where they are credited to an account in his name. Regarding a trip to Russia to tap this unexpected resource, he said, "I don't have any definite plans, but I think it would be a nice trip."

Dr. Webb recently obtained his doctorate in atmospheric sciences from Colorado State University, and he teaches evening graduate courses at the University of Texas at El Paso. Meanwhile, he is working on a massive document reporting on meteorological research studies he hopes to have published in the highly prestigious series of Army Research and Development Monographs.

APG Adopts Key Chain as Weapons Testing Safety Device

Increased safety in weapons testing at Aberdeen (Md.) Proving Ground is credited to an employe's suggestion to use a commonplace key chain reel.

A small case with a retractable 2-foot chain and key ring has been adopted for use as a safety device in the operation of T-3 firing boxes. Worn on the belt of an operator, this reel may find applicability at other Army Materiel Command installations and activities.



In the firing of rockets and other weapons, the T-3 firing box is actuated by a key-operated rotary switch used as a lockout, in concert with a "double banana" plug.

When engaged, the system is in series with a push-button switch, the activation of which closes the circuit and fires the weapon.

Clyde E. Sinclair of the Materiel Testing Directorate's (MTD) Supply Branch, suggested that the key and jumper plug be placed on a retractable key chain reel.

One safety feature of the reel is that the person responsible for operating the firing box has the lockout key and jumper plug in constant possession. The firing circuit cannot be energized without the device.

Neither the key nor plug can be forgotten in the firing box, since the operator can travel no more than two feet without having to disengage them or release them from his belt; also, this reduces the possibility of losing either the key or plug.

The key chain reel may serve similarly in remote firing or remote demolition operations at other installations and activities. They have been requested to consider the adoption of the suggestion and to notify the APG Incentive Awards Officer as to their opinions of the device, so that it may be reevaluated.

"If a man does not keep pace with his companions, perhaps it is because he hears a different drummer. Let him step to the music which he hears, however measured or far away." THOREAU

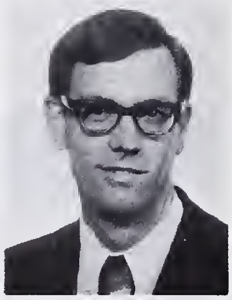
Career Programs

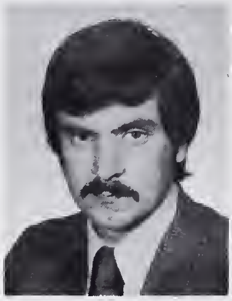
List of Outstanding Young Men Includes 6 Employed at Edgewood

James D. Wood

David M. English

Carl E. Gepp


Michael R. Miller


John S. Richardson

Edward A. Coale

Six employes of the U.S. Army Chemical Research and Development Center, Edgewood Arsenal, Md., have been selected for inclusion in the 1972 edition of *Outstanding Young Men of America.*

Nominations are made annually by a cross section of the nation's civic organizations, Junior Chamber of Commerce chapters, college alumni associations and military commandants. Nominees must be from 21 to 35 years old, and have demonstrated excellence that has marked them for future national leadership.

Edgewood selectees are:

David M. English is an electrical engineer assigned as acting chief engineer of the Physical Protection Branch in the Directorate of Development and Engineering. He has served as a development/project engineer in Collective Protection Research and Development since his arrival at Edgewood in 1967.

Graduated in 1959 with a BS degree in electrical engineering from Bucknell University, he has done postgraduate work at the American Management Association, Chicago, Ill. He received an Outstanding Performance Award with a Quality Increase in 1971.

James D. Wood, a research analyst, is assigned to the Systems Analysis Division in the Directorate of Development and Engineering. During 1962–66 he was a research meteorologist, first with the Chemical Research and Development Laboratory and later with the Technical Support Directorate.

He has a 1960 BS degree in meteorology from Pennsylvania State University and a 1970 master's degree in management science from the Johns Hopkins Evening College. He is also a member of the Operations Research Society of America.

Michael R. Miller is a mathematician serving as supervisor in the Test and Evaluation Division of the Technical Support Directorate. He began his service at Edgewood Arsenal in the Field Evaluation Division of the Chemical Research and Development Laboratories in 1963.

Miller has a 1963 BS degree in mathematics from Moravian College, has authored or coauthored 15 technical reports and publications in professional journals, and has received a Sustained Superior Performance Award.

John S. Richardson is serving as a draftsman and engineering technician in the Technical Support Directorate. He came to the arsenal in 1968, following three years employment at the Bendix Corp. He received jet engine technician training while in the Air Force and is currently attending Harford Community College, Bel Air, Md.

Carl E. Gepp is a chemical engineer engaged in research and development in the Ground Munitions Branch of the Directorate of Development and Engineering.

He has a 1960 BS degree in chemical engineering from Michigan Technological University and is currently working on a master's degree in business administration through George Washington University. Gepp also holds a U.S. patent and has received numerous letters of appreciation and awards for his suggestions.

Edward A. Coale is a chemical engineer who has served in the Weapons Branch in the Manufacturing Technology Directorate since he came to the arsenal in 1968. He has a BS degree in chemical engineering from the University of Maryland.

President's Program Includes MUCOM Selectee

President Nixon's Commission on Executive Interchange, a government-industry program to exchange high-potential young managers, has lured one of the Army Missile Command's division chiefs with a challenging opportunity.

Nominated as a Department of Defense selectee, Ernie Young, 39-year-old chief of the Hawk System Support Division, is leaving a $30,000 job to work for at least a year as assistant to the purchasing manager for United Aircraft Corp. He has been a U.S. Civil Service employe for 14 years and has been with the Army Hawk developmental program since 1962.

The executives who are getting a taste of life on the other side of the business-government fence range in age from 25 to 40, and have been picked in a highly selective process.

"I'm told I'll be dealing with foreign countries who do business with the corporation to determine what goods and services United might buy from them," says Young. "I'm excited about it because I'll be traveling to those countries to look at production facilities before we negotiate contracts.

"I think it'll be broadening from the standpoint of personal development . . . and I'm looking forward to the challenge."

The Commission on Executive Interchange is charged with improving government-industry relations by enabling young executives to work together in the interest of better understanding of capabilities and problems.

A commission spokesman stated: "Many of our domestic, social and environmental problems will be solved only through the combined efforts of business and government.

Ernie Young

Israeli Scientist Joins CRREL for Year

Dr. Amos Banin has joined the staff of the U.S. Army Cold Regions Research and Engineering Laboratory for one year as a visiting scientist.

An expert in the field of physical chemistry of soils and clay, he is senior lecturer at and graduate from Hebrew University, Israel. He is a member of the International Soil Science Society, American Soil Science Society, and the Clay Minerals Society.

While at the Hanover, N.H., laboratory, Dr. Banin will investigate methods of rapidly determining the specific surface area of soils by automated, remote control; measurement and evaluation of light absorbed and reflected from soils and clays during freezing and thawing; and the feasibility of distinguishing frozen from unfrozen soil by remote sensing methods.

Dr. Amos Banin

Outstanding Young Men of America Lists Nine Frankford Scientists

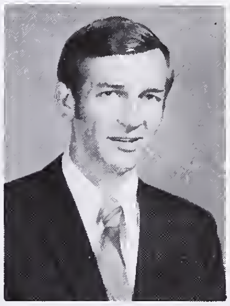
Donald R. Furmanski

Samuel L. Brown

Kenneth R. Pfleger

David J. Reap

James A. Donahue


Dr. James F. Kowalick

Bruce W. Brodman

Dr. Kenneth A. Green

Walter J. Ryba

Nine scientists who have distinguished themselves in R&D at Frankford Arsenal, Pa., have been selected for listing in the 1972 edition of *Outstanding Young Men of America*.

Nominated earlier this year by COL James L. Wallace, Frankford Arsenal CO, they were recognized for community leadership as well as their professional achievements. They are:

Bruce W. Brodman, chemist in the Small Caliber Propellants and Pyrotechnics Division of the Munitions Development and Engineering Directorate; Samuel L. Brown, mechanical engineer in the Munitions Development and Engineering Directorate; James A. Donahue, acting chief of the Ammunition Ballistic Range, Technical Support Directorate; and

Donald R. Furmanski, systems engineer in the Fire Control Development and Engineering Directorate; Dr. Kenneth A. Green, Applied Science Division of the Pitman-Dunn Laboratory; Dr. James F. Kowalick, acting chief of the Pyrotechnics Development Branch, Munitions Development and Engineering Directorate; and

Kenneth R. Pfleger, fire control electronics engineer in the Artillery, Infantry and Armored Weapons Division of the Fire Control Development and Engineering Directorate; David J. Reap, project engineer in the Munitions Development and Engineering Directorate; and Walter J. Ryba, engineer in the Air Defense and Weapons Division of the Fire Control Development and Engineering Directorate.

Bruce W. Brodman has been employed at Frankford Arsenal since 1961. He has a BS degree in chemistry from the Philadelphia College of Pharmacy and Sciences, and has completed three years of graduate study at Temple University and a course in infrared spectroscopy at the Massachusetts Institute of Technology.

In his present position he is responsible for planning, proposing, consulting on, performing, directing and coordinating R&D activities in chemistry and the specific area of small arms propellants. Coauthor of 9 professional journal publications and 12 technical reports, he has one U.S. patent and has two pending. He has received nine Department of the Army official commendations for his open literature publications.

Samuel L. Brown came to Frankford Arsenal in June 1959 as an engineering aide under the Army-sponsored trainee program (summer) for college students preparing for scientific or engineering professions. Upon graduation from North Carolina Agricultural and Technical State University, 1960, he returned to Frankford Arsenal.

His principal effort has involved analytical and experimental problems in interior, exterior and terminal ballistics primarily for small caliber ammunition and related equipment. His present assignment is senior project engineer for the 20mm Ammunition Program for the Vehicle Rapid Fire Weapon System-Interim, (VRFWS-1).

James A. Donahue has been employed at Frankford Arsenal since 1967. His present duties involve the operation of Frankford Arsenal's ballistic range complex as well as overseeing the implementation of new ballistic test equipment and in particular, an automated data acquisition system (Automatic Range Management System—ARMS).

Donahue has completed course work for a degree of master of engineering science at Penn State University. He has published a paper on ballistic holography and has presented a conference paper titled "Automatic Data Acquisition for Ballistic Testing."

Donald R. Furmanski has been a second-generation Frankford Arsenal employe since 1962, following graduation with BS degree in mechanical engineering from the University of Pennsylvania. He received the "Federal Service Employe of the Year" Award in 1970 for his exceptional contributions to the improvement of armed helicopter capabilities in Southeast Asia and was awarded a Department of the Army Research and Development Achievement Award in 1971.

Dr. Kenneth A. Green has been employed at Frankford Arsenal since 1969. Assigned in the Applied Science Division of the Pitman-Dunn Laboratory, he performs research and exploratory investigations in heat transfer and thermodynamics to support projects involving high-energy laser radiation. Dr. Green holds BS, MS and PhD degrees in mechanical engineering from Drexel University.

From 1969 to 1971, Dr. Green served as a captain in the United States Army with duty stations at the White Sands Missile Range, N. Mex., and at the Cam Ranh Army Depot, Vietnam, where he was awarded the Bronze Star medal.

Dr. James F. Kowalick has been a Frankford Arsenal employe since 1959. He holds a BS degree from Lehigh University (1959), and a PhD degree from Drexel University (1970). Dr. Kowalick is the author of 18 technical reports in addition to a monograph dealing with the area of high explosives, 13 open literature publications and holds 11 United States patents.

His professional activities include service as U.S. Army Representative to the Technical Coordinating Panel (United Kingdom, Canada, Australia and the United States); membership on the National Steering Committee on Pyrotechnics of the American Ordnance Association; U.S. Government liaison representative to the Propellants and Explosives Section, American Ordnance Association; past secretary of the Explosives Components Subcommittee, Joint Army-Navy-Air Force Fuze Committee, Washington, D.C.

Kenneth R. Pfleger has been employed six years as a fire control electronics engineer in the Artillery, Infantry and Armored Weapons Division of the Fire Control Development and Engineering Directorate. He received a BS degree from Drexel University in 1966.

In 1969 Pfleger published a report titled "Evaluation of Combat Vehicles Fire Control Gunnery Systems" which has been widely acknowledged. He is awaiting the outcome of a patent application on a tank ballistics computer.

David J. Reap is a 1966 Villanova graduate with a BE degree in mechanical engineering and has pursued graduate studies in engineering at Penn State. He is assigned as a project engineer for artillery fuzes and his primary duties concern product improvement of artillery

(Continued on page 40)

9 Frankford Arsenal Scientists Make Outstanding Men List

(Continued from page 39)

fuzes. Author of three technical reports, he was recently given a Sustained Superior Performance Award.

Walter J. Ryba is a project director of a technology program sponsored by the U.S. Army Weapons Command to exploit the latest developments in equipment to be used for the fire control on helicopter, air-defense and ground vehicle systems.

He has been employed at Frankford since 1961 after graduating with a BSEE degree at Villanova University. While employed at the arsenal he has attended classes at Drexel University, receiving an MSEE degree in 1967.

career programs

Metrication Course Offered Under NBS, GWU Sponsorship

A short course on "Problems in Metrication," cosponsored with the National Bureau of Standards, Department of Commerce, will be conducted at George Washington University, Washington, D.C., Nov. 13–15.

Designed to meet the needs of research and development, design, and manufacturing engineers on whom the greatest burden of problems of conversion to the metric system will fall, the course will cost $225.

Interest in metrication results from the recommendation to Congress in July 1971 by the Secretary of Commerce that the United States change to the metric system. The Metric Conversion Act of 1972 passed by the Senate to establish policy calls for development of new or revised engineering standards based on metric units.

Additional information on the course may be obtained from: Continuing Engineering Education Program, George Washington University, Washington, D.C. 20006.

Automatic Message System Replacing Manual Technique

AMES (Automatic Message Entry System), a combination optical character reader and computer, is replacing the manual preparation of messages at Army Telecommunications Centers.

The new system reads, addresses and formats narrative messages for entry into the Department of Defense worldwide AUTODIN (automatic digital network).

Since it went into operation at Fort Huachuca, Ariz., in April 1969, AMES has reduced message handling by 80 percent. The reductions in time and personnel have remained in effect over the past three years even though narrative data traffic has increased from 167,000 messages in 1968 to 222,000 in 1971.

The AMES at Fort Huachuca is one of 11 operated by the Army's global Strategic Communications Command (STRATCOM). Based on the performance of AMES, STRATCOM plans to equip all Army Telecommunications Centers with units.

14 Army Employes Selected for Graduate Studies

Under a Department of the Army educational program, 14 scientists, engineers and technicians from the U.S. Army Mobility Equipment Research and Development Center (MERDC) and the U.S. Army Engineer Topographic Laboratories (USAETL), Fort Belvoir, Va., have been selected for graduate studies.

The program, which provides for full-time study at colleges and universities with payment of normal salary, is intended to enhance capabilities of personnel considered to have outstanding potential for future research and development assignments.

Participants in the program are required to remain in Army or Department of Defense positions for a period equivalent to three times their training period.

Personnel selected from the MERDC, their fields of study and the universities they will attend are: James T. Watson, business administration, University of Maryland; Michael A. Callahan, organic and physical chemistry, George Washington University; Frederick L. Roder, nuclear science and nuclear physics, Catholic University; Francis M. Cevasco, business administration, George Washington University; and Dario A. Emeric, chemistry, George Washington University; James E. Carney, engineering administration, University of Missouri at Rolla; Martin E. Falk, civil engineering, Stanford University; and Raymond V. Nolan, engineering administration, George Washington University.

Topographic Laboratories participants are: Donald P. Dere, mathematics, George Mason University; Richard A. Hevenor, electrical engineering, George Washington University; Larry N. Scartz, physics, George Mason University; Robert K. Brooks, electrical engineering, University of Maryland; Walter E. Boge, photogrammetry, Purdue University; and Joseph Zabransky, meteorology, University of Wisconsin.

QUOTE: "(Basic) research means going out into the unknown with the hope of finding something new to bring home. If you know in advance what you are going to find there, or even what you are going to do, then it is not research at all; then it is only a kind of honorable occupation."

Albert Szent-Gyorgyi, 1971

Royal Military College of Science Bid Accepted

The United Kingdom Ministry of Defence has, by formal letter through diplomatic channels, invited the U.S. Army to nominate an officer to attend the No. 23 Guided Weapons Systems Course at the Royal Military College of Science in Shrivenham, England.

MAJ Paul T. Wickliffe, assigned to the headquarters staff of the Department of the Army, has been nominated to attend the course from Jan. 4 to Dec. 14, 1973. He earned a bachelor's degree in science from Eastern Michigan University in 1960 and has graduated from the Command and General Staff School at Fort Leavenworth, Kans.

Candidates graduated from the Royal College course will be granted master of science degrees in engineering (guided weapons systems). The course is designed to develop an officer's understanding of science and technology and their application to defense problems.

MAJ Wickliffe's nomination renews a former program of cooperation between the United States and the United Kingdom. The Royal Military College of Science was founded in 1946.

Dental Corps Officers Selected For Special Studies Program

Eighteen Dental Corps officers are enrolled in a new program of graduate studies leading toward an MS degree in special studies at the U.S. Army Institute of Dental Research (USAIDR) by George Washington University, Washington, D.C.

The agreement setting up the program, which concentrates on oral biology, calls for a cooperative educational endeavor. Certain courses taught by both GWU faculty and USAIDR personnel will be accredited by the university.

The majority of courses will be devoted to didactic instruction. Clinical work will be conducted two days each week at USAIDR research facilities.

Similar course material has been offered to dental officers in previous years, but this is the first program of its kind directed toward a master of science degree. Training also will fulfill a requirement preparatory to becoming a Diplomate in endodontics and periodontics.

The program was launched recently in ceremonies at the university when BG Surindar N. Bhaskar, director of USAIDR, Eugene R. Macgruder, dean of the College of General Studies, and Arthur E. Burns, dean of the Graduate School of Arts and Sciences at GWU, signed the agreement.

4 AMC Civilians Pursue Studies At Systems Management School

Four Army Materiel Command (AMC) civilian employes from major subordinate commands are attending the Program Management Course at the Defense Systems Management School, Fort Belvoir, Va.

Selected from among Army personnel who are promising candidates for senior positions in project management, the students are: Jay B. Berkowitz and F. G. Perkins, both from the U.S. Army Mobility Equipment Research and Development Center (MERDC), Fort Belvoir; George W. Watts, U.S. Army Electronics Command (ECOM), Fort Monmouth, N.J.; and M. I. McKinney, U.S. Army Weapons Command (WECOM), Rock Island, Ill.

The 5-month course, offered twice yearly, covers the fundamentals and most effective methods of program/project management. Held twice yearly, the course allots quotas of 15 military and 4 civilian from each Military Department, and 3 civilian students assigned to the defense industry in liaison functions.

Eligible to attend the course are lieutenant colonels and majors from the Army, Air Force and Marine Corps; commanders and lieutenant commanders from the Navy; and civilians from all services in the grades of GS-12 and GS-13.

People in Perspective . . .

Wife's Faith in Husband's Talent Pays With $3,000 Award by Reader's Digest

People who think they can write, but have little or no talent, have flooded editors with material meriting only rejection slips since time immemorial.

Joseph G. Garvey, at age 64, *did not* believe he could write, though he had long desired to try, but his wife believed he had talent. When he found that he had time on his hands last spring, Garvey did some serious thinking.

Why not try! Hadn't his poetry for retiring coworkers in the Evans area machine shop at HQ U.S. Army Electronics Command, Fort Monmouth, N.J., received acclaim time and again?

Garvey decided to enter adult night school courses offered at Long Branch High School. The instructor there agreed with Mrs. Garvey that her husband showed undeveloped talents in a Writers' Workshop course. Under Sidney Porcelain's guidance, Garvey began developing the germ of a story that had long been in his mind—a story about his father and Ireland, from which Garvey had emigrated 40 years earlier.

When that story was put down on paper, and read aloud to fellow students, the response was encouraging, in fact, laudatory. Instructor Porcelain and some of the students suggested *Reader's Digest* might be interested. Garvey recalls:

"I thought it was too presumptuous at the time and when I told my wife, she said, 'What do you have to lose, only an 8-cent stamp?' "

With the heady bloom of the initial praise gone, Garvey's confidence about the merit of his story waned. The manuscript was shelved for months until his wife's continued urging prodded him to submit it.

Mr. and Mrs. Garvey and family

About six weeks later he received a telephone call from William A. H. Birnie, *Reader's Digest* senior editor, who told him his story was under consideration for the "first person" award. Birnie's praise was pretty strong drink—even for a good Irishman! Then this letter followed:

"Dear Mr. Garvey:

"It's with the greatest pleasure that I enclose this check. Have a great trip to Belfast and let me see some more manuscripts from you. Wish I had known your father—and your mother, too.

Sincerely,
W. A. H. Birnie."

Garvey and his wife went to Ireland on a vacation, which had been planned long before the birth of the manuscript. The $3,000 "first person" award made their trip much more pleasant.

Now, with the further enjoyment of seeing his story published in the near future, Garvey is thinking of devoting more time to writing. But he's wondering if he is a one-manuscript author—one shot and he has had it.

His wife doesn't think so. Neither does instructor Porcelain, Garvey's eight children—and, of course, Mr. Birnie of *Reader's Digest*.

How to Budget Time

Picatinny Man Proves Skill

If you are one of the millions of Americans who frantically and somewhat frenetically dash around futilely trying to maintain an impossible schedule, you might take a cue or two from Maitland McLarin on how to budget time.

McLarin, an employe of the Product Assurance Directorate at Picatinny Arsenal, Dover, N.J., is an active member of 36 professional, civic and community organizations. He's what you call an indefatigable joiner.

How does he keep up with the demands on his time? Well, for one thing, even during his sleep he listens to taped proceedings of scientific meetings he somehow missed or attended in part.

McLarin is a great believer in sleep learning. The brain, he maintains, is in effect an informational retrieval system capable of receiving unlimited knowledge, especially during sleep intervals. Subliminal learning keeps him abreast of advanced technology in computers, astronomy, aeronautics and astronautics—to mention only a few of his interests.

You might presume that membership in 36 organizations on an active participation basis would leave him little time for anything else. Wrong! But then how many men are willing to get on the golf course by 5 a.m.?

What about the household duties that plague many a home owner? Well, not McLarin. Somehow he finds time to service and repair four family cars, do his own plumbing and electrical work, and perform the usual routine chores.

McLarin concedes, however, that he works hard at devising shortcuts—such as attending three or four meetings a night by the process of avoiding business phases, dinners and drinks. Included in a partial listing of his memberships are:

The American Institute of Aeronautics and Astronautics (he was an electronics engineer with NASA during the initial launching of the Apollo); Amateur Astronomers, Inc.; Simulation Councils, Inc.; Data Processing Management Association; and National Audubon Society.

In his view, "it all adds up to the joy of living."

Maitland McLarin

ECOM Cites Woman for 3 Decades of Service

Mrs. Emma Luke, an electronics engineer, recently completed 30 years of service with the U.S. Army Electronics Command (ECOM) and its predecessor organizations at Fort Monmouth, N.J., and was presented a Federal Civil Service certificate and pin.

Mrs. Luke has a BS degree from the University of Maine and a master's from Monmouth College, both in mathematics. For the past 10 years, she has been assigned to ECOM's Directorate of Research, Development and Engineering (RD&E) and earlier was with the Communications Automatic Data Processing Laboratory.

She is a member of Fort Monmouth's chapter of Federally Employed Women (FEW), the Armed Forces Communications Electronics Association (AFCEA), and the Institute of Electrical and Electronic Engineers (IEEE).

Mrs. Luke is also active in the Institute of Electrical and Electronic Engineers' subgroups on Communications; Electromagnetic Computibility and Systems; and Man and Cybernetics.

Mrs. Emma Luke

Personnel Actions . . .

OCRD Lists 8 Staff Assignments

Eight officers arrived recently for staff assignments with the Office of the Chief of Research and Development (OCRD), Department of the Army.

COL Lewis R. Baumann is the new chief of the Combat Materiel Division, following a tour as brigade commander, 4th Infantry Division, Fort Carson, Colo.

In Vietnam, he served first as deputy brigade commander, 1st Brigade, 5th Mechanized Division and later as G-1, 24th Corps (1969-70), following a 3-year tour of duty in the Office, Director of Studies, Office, Assistant Vice Chief of Staff, Washington, D.C.

COL Baumann has a 1949 BS degree from the United States Military Academy (USMA), West Point, N.Y., and a 1962 MS degree in mechanical engineering from Georgia Institute of Technology. He is also a graduate of the Army War College.

His military honors include the Silver Star (SS) with four Oak Leaf Clusters (OLC), Legion of Merit (LM) with two OLC, Distinguished Flying Cross (DFC) with OLC, Bronze Star Medal (BSM) with "V" device and two OLC, Air Medal (AM) with 16 OLC, Army Commendation Medal (ARCOM) with "V" device and OLC, Purple Heart with OLC and the Navy Commendation Medal.

COL (BG designate) Donald R. Keith heads the Developments Directorate and is fresh from a tour as director, Research and Analysis, Civil Operations and Rural Development Support, Military Assistance Command, Vietnam (MACV).

In 1970-71 he was executive officer, Office of the Chief of Research and Development, following three years in Germany—first as commanding officer, 5th Battalion, 73d Artillery and later as CO, 36th Field Artillery Group.

COL Keith graduated from the USMA in 1949 and has a 1958 MA degree in science education from Columbia University. He is a graduate of the Army Command and General Staff College, Armed Forces Staff College and the Industrial College of the Armed Forces (ICAF). He is coauthor of *Management of Defense Research and Development,* an ICAF thesis published in 1968.

His military awards include the LM with two OLC, BSM, Meritorious Service Medal and the ARCOM with OLC.

LTC Larry J. Baughman is a staff officer with the Air Mobility Division. In Vietnam (1969-70), he served first as CO, 214th Aviation Battalion and later G-3, 1st Aviation Brigade.

During 1966 he commanded A Company, 82d Aviation Battalion, Vietnam, followed by a 3-year tour as aviation staff officer, Canadian Forces, HQ, Ottawa. He was S-3, 145th Aviation Battalion, Vietnam in 1965. In 1960-63 he was CO, B Company, 1st Brigade, 7th Infantry, Germany and later project officer, Aircraft Armament Division, Fort Rucker, Ala.

LTC Baughman has a 1964 bachelor's degree in general education from the University of Nebraska at Omaha and a 1972 master's degree in business administration from Shippensburg State College. He is a graduate of the Army Command and General Staff College and the Army War College.

Among his military awards are the SS, LM with OLC, DFC with OLC, BSM with OLC, MSM, AM with OLC and the ARCOM with OLC.

LTC Robert J. Cuthbertson has been assigned as a staff officer with the Programs Branch, Programs and Budget Division.

During 1971-72 he served as battalion commander, 426th Supply and Service Battalion, 101st Airborne Division, Air Mobile. In 1969-70 he was the general materiel, airborne, nuclear, biological and chemical warfare representative for the U.S. Army Standardization Group, Canada.

In 1967-68 he was a quartermaster staff officer and chief of the Air Mobility Branch, Materiel Division, Combat Developments Command, Special Warfare Agency, Fort Bragg, N.C.

LTC Cuthbertson has a 1955 BA degree in history from the University of New Hampshire, and is a graduate of the Army Command and General Staff College.

His military honors include the LM with OLC, MSM, AM and the ARCOM with two OLC.

LTC Louis Friedersdorff is chief of the Surveillance Target Acquisition and Night Observation Branch (STANO), Command Systems Division.

During 1970-72 he commanded the 3d Battalion, 35th Field Artillery, Germany. He served from 1969-70 as CO, 2d Battalion, 11th Artillery and as executive officer, Division Artillery in the 101st Airborne Division. In 1968-69 he was chief of the Tactical and Air Defense Branch, Field Command Defense Atomic Support Agency, Albuquerque, N. Mex.

LTC Friedersdorff is a 1953 USMA graduate, has a 1958 master's degree in electrical engineering from Purdue University, and is a graduate from the Army Command and General Staff College.

His military honors include the LM, DFC, Soldier's Medal (SM), BSM, MSM, AM (12 awards with "V" device), and the ARCOM with OLC.

LTC Joseph P. Goncz is a new staff officer with the Plans Division, following a tour as chief, Ammunition Branch, Materiel Division, Office of the Deputy Chief of Staff for Logistics, Vietnam.

During 1967-71 he was test group director, Nuclear Weapon Effects Test, Test Command, Defense Atomic Support Agency, Sandia Base, N. Mex. During 1966-67 he commanded C Company, 335th Maintenance Battalion, Korea, and later was security plans and operations officer, HQ, 19th General Support Group, Korea.

LTC Goncz has a 1954 BS degree in business and engineering administration from Massachusetts Institute of Technology, a 1965 MS degree in physics from the U.S. Naval Postgraduate School, and is a graduate of the Army Command and General Staff College. His military honors include the LM and the MSM.

LTC Frank M. Hungerford is a staff officer with the Nuclear, Chemical and Biological Team, Missiles and Special Weapons Division. During 1970-72 he served first as CO, Sergeant Replacement Packet, Fort Sill, Okla. and later as CO 3d Battalion, 81st Field Artillery, Korea.

He was Lance project officer with the Field Command, Defense Atomic Support Agency (1967-70). From 1962-65 he was Sergeant missile project officer, U.S. Army Field Artillery Board and was later subsector adviser, Military Assistance Command, Vietnam.

LTC Hungerford has a 1952 BS degree in education and mathematics from South West Missouri State College and a 1962 MS degree in mechanical engineering from the University of Arizona. He has graduated from the Army Command and General Staff College.

His military awards include the BSM, MSM, and the ARCOM with OLC.

MAJ Carl H. Cameron is a staff officer in the Terminal Defense Program Office, U.S. Army Advanced Ballistic Missile Defense Agency, following 1967-69 duty as commander of a Nike-Hercules Battery and later as project officer with the Combat Developments Command.

During 1964-66 he was an instructor at the Air Defense School, Fort Bliss, Tex., after serving (1959-63) as a platoon leader for a Nike-Hercules Battery.

MAJ Cameron has a 1958 BS degree in mathematics from Wofford College and a 1972 master's degree in civil engineering from the University of South Carolina. He is a graduate of the Army Command and General Staff College. His military decorations include the BSM, Joint Service Commendation Medal (JSCM) and the ARCOM with OLC.

COL Robinson Named Air Mobility Lab Deputy

COL Norman L. Robinson, former commanding officer of the Yuma (Ariz.) Proving Ground, has been selected as deputy director of the Army Air Mobility R&D Laboratory, established in 1971 with headquarters at the Ames Research Center, Moffett Field, Calif.

In this capacity he will continue his assignments in research and development, and will also bring to the laboratory a broad background of worldwide experience in military assignments. He will be the principal military adviser to Director Paul F. Yaggy.

COL Robinson has a master of science degree in aerospace engineering from the University of Arizona, and is a graduate of the U.S. Army Command and General Staff College.

COL Norman L. Robinson

ACSG Scientific Adviser Graded as PL-313

Civil Service Commission approval of Fred W. Wolcott for appointment to one of the U.S. Army's prestigious, top-salaried PL-313 positions, as scientific adviser at HQ Army Combat Systems Group, Fort Leavenworth, Kans., was announced recently.

Wolcott has served since September 1971 as acting scientific adviser at HQ U.S. Army Combat Developments Command, Fort Belvoir, Va. David C. Hardison has returned to that position, which he has held since 1964, following graduation from the National War College at Fort McNair in Washington, D.C.

Unitil he accepted the temporary CDC assignment, Wolcott was with the Philco-Ford Corp. branch office in Washington, D.C., as manager for advanced planning. From 1963 to 1969, he was vice president of the Research Analysis Corp. (RAC), McLean, Va.

Wolcott entered Federal Civil Service in 1959 when he was appointed special assistant to the Director of Defense Research and Engineering (DDR&E). In June 1960 he became Assistant Director of Defense Research and Engineering (Tactical Weapons), serving until he returned to industry in May 1961.

Earlier he served nearly four years with Douglas Aircraft Co., Inc., as chief of the Advanced Design Section, Engineering Dept., the last three months as assistant to the chief engineer for advanced engineering planning.

Since 1957, when he was appointed to the Aerial Delivery Research Committee, National Research Council Advisory Board on Quartermaster R&D, Wolcott has served in a succession of high-level U.S. Government and NATO assignments. He headed the U.S. scientific delegation which conducted the NATO Long-Range Scientific Study in conjunction with other delegations in 1961.

In addition to various top-level advisory appointments with the U.S. Navy and the Air Force and similar service with major Army commands after being one of five civilian members of the Army Tactical Mobility Requirements Board (Howze Board) in 1962, Wolcott has performed as:

Fred W. Wolcott

- Member, Military Aircraft Panel, President's Science Advisory Committee, 1964 to present.
- Member, Vietnam Panel, President's Science Advisory Committee, 1969 to present.
- Member, Blue Ribbon Committee (appointed by the President) for the Cheyenne Helicopter Program, 1969.
- Member, Air Traffic Control Panel, President's Science Advisory Committee, 1969 to present.
- Member, NATO Air and Ground Operations Panels, President's Science Advisory Committee, 1970 to 1972.

Wolcott was graduated from the University of Michigan with a BS degree in aeronautical engineering. He is an Associate Fellow, American Institute of Aeronautics and Astronautics; member, Operations Research Society of America; and licensed mechanical engineer, State of California.

Bennett Designated as PM For Development of FAMECE

LTC Joseph D. Bennett has been assigned project officer for the Family of Military Engineer Construction Equipment (FAMECE) at the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.

LTC Bennett served as commanding officer, 16th Engineer Battalion, 1st Armored Division, 1967–69; as staff officer, Deputy Chief of Staff for Logistics, Department of the Army, 1969–71; and as staff engineer and inspector general advisor, II ARVN Corps, 1971–72.

He received his bachelor's degree in building construction from the University of Florida and master's degree in industrial engineering from Arizona State University. He is a member of the Society of American Military Engineers, a graduate of the Command and General Staff College, and has completed the Army Engineer Officer Basic and Advanced Courses.

Included among his awards and decorations are the Legion of Merit, Bronze Star, Air Medal, Army Commendation Medal with two Oak Leaf Clusters, the Vietnamese Staff Medal (First Class), and the Vietnamese Honor Medal.

FAMECE is a sectionalized, articulated or hinge steering, pneumatic tire earthmoving system having a standard power module and one of the following construction work modules: dozer, loader, grader, scraper, dumper, water distributor, or compactor.

3 STRATCOM Civilians Chosen as CEEIA Division Chiefs

The Communications Electronics Engineering Installation Agency (CEEIA), U.S. Army Strategic Communications Command (STRATCOM), Fort Huachuca, Ariz., has announced the assignment of three new civilian executives.

New division chiefs in the Communications Engineering Directorate are Feliciano Giordano, Standards; Hans Van Gelder, Special Systems; and Ray E. Thompson, Transmission Engineering.

Giordano comes to CEEIA from STRATCOM's Communications Systems Agency, Fort Monmouth, N.J., where he was chief of the Engineering Management Division, Office of the Deputy Project Manager, Integrated Communications System-Pacific.

As a Signal Corps captain, Giordano was a special project officer and officer-in-charge of STRATCOM's Coltano (Italy) Communications Site, and station engineer and plant branch officer in charge, Camp Darby, Italy.

Giordano earned his BS degree in electrical engineering from Northeastern University, Boston, and his master's in the same field from Fairleigh Dickinson University, Teaneck, N.J.

Van Gelder, a native of The Netherlands, was with Mitre Corp., McLean, Va., as a task leader prior to joining CEEIA. He interrupted his education at the Massachusetts Institute of Technology to serve in the Air Force. Following graduation from MIT with a degree in electrical engineering, he earned his master's in that field from the University of Pittsburgh. He has held several managerial and engineering positions in industry.

Thompson was a project director at the Naval Electronics Laboratory, San Diego, prior to joining CEEIA. A native of Salt Lake City, Utah, he earned a bachelor's degree in electrical engineering from the University of Utah and was a graduate student at the University of California at Los Angeles.

A former head of the spacecraft systems engineering office, NASA Manned Spacecraft Center, Houston, he has held such positions as design specialist for General Dynamic's Astronautics Division, San Diego, and project engineer, Naval Ordnance Test Station, China Lake, Calif.

DID YOU KNOW? A British "billion" is a million million, or a thousand times as large as a U.S. "billion," which is only a thousand million. Counting at the rate of one per second, it would take nearly 32 years to count a U.S. billion, but it would take several hundred lifetimes (31,709 years) to count a British billion.

Feliciano Giordano

Hans Van Gelder

Ray E. Thompson

Dr. Elisberg Leaves WRAIR to Join HEW Staff

Dr. Bennett L. Elisberg resigned recently as chief of the Department of Rickettsial Diseases, Walter Reed Army Institute of Research (WRAIR), U.S. Army Research and Development Command (USAMRDC).

Employed with WRAIR since 1961, he will soon join the Bureau of Biologics, Food and Drug Administration, Department of Health, Education, and Welfare. During 1955–61 he served with the U.S. Army Medical Research Unit, USAMRDC, Kuala Lumpur, Malaysia, the last two years as deputy director. In 1953–54 he served with the U.S. Army Medical Corps.

Dr. Elisberg graduated from New York University in 1944, and received an MS degree (1948) and doctorate (1950) from Tulane University School of Medicine.

Dr. Elisberg has authored more than 20 publications in professional journals. He is a member of the American Society of Microbiology, the American Association for the Advancement of Science, the New York Academy of Sciences, the Wildlife Disease Association, the American Institute of Biological Sciences, the American Association of Immunologists, the American Society of Tropical Medicine and Hygiene, and the Commission on Rickettsial Diseases, Armed Forces Epidemiological Board.

Ross Heads Deseret Test Center

LTC Paul E. Ross is the chief of the Deseret (Utah) Test Center following the recent retirement of LTC Raymond E. Coursin.

Since completing two years duty as director of procurement at Edgewood (Md.) Arsenal in 1965, LTC Ross has served as senior chemical adviser, HQ Korean Military Advisory Group; chief of staff, Deseret Test Center (DTC); chief, Stock Fund, Secondary Item Division, Office of the Deputy Chief of Staff for Logistics; project manager/staff officer, DTC; and chief, Program Control Office, and special assistant to the scientific director, DTC.

LTC Ross began his Army career in 1941 and attended Officer Candidate School at Edgewood (Md.) Arsenal to earn a commission in the Chemical Corps as a second lieutenant in 1942.

ECOM Announces MALR Product Manager

LTC William J. Harrison has been designated the first U.S. Army Materiel Command (AMC) product manager for Mortar/Artillery Locating Radars (MALR) at HQ U.S. Army Electronics Command, Fort Monmouth N.J.

He is responsible for planning, directing and controlling the allocation and utilization of all resources authorized for these developmental programs. Management involves participation with other branches of the U.S. Armed Forces, including several U.S. Army commands for support and coordination.

LTC Harrison served in 1970–71 as assistant secretary of the general staff, Office of the Chief of Staff. In 1969–70 he commanded and later was assistant fire support coordinator, 1st Battalion, 1st Cavalry Division, Vietnam. During 1967–69 he was R&D communications electronics action officer, Office of the Chief of Research and Development, HQDA.

Graduated from the United States Military Academy in 1952, he has received two master's degrees, in international affairs from George Washington University and electrical engineering from the Georgia Institute of Technology. He has also attended the Naval War College and the Industrial College of the Armed Forces.

His military honors include the Legion of Merit, Bronze Star with "V" device and two Oak Leaf Clusters, Meritorious Service Medal with Oak Leaf Cluster (OLC), Air Medal with "V" device and eight Oak Leaf Clusters, and the Joint Service Commendation Medal.

LTC William J. Harrison

personnel actions

McDonald Succeeds Levy as MMCS Commandant

COL Thomas J. McDonald has taken over as commandant of the Army Missile and Munitions Center and School (MMCS), Redstone Arsenal, Ala., succeeding recently retired COL Gilbert P. Levy.

COL McDonald, who recently served as commander of Letterkenny Army Depot, Pa., has pioneered in the use of television and other audiovisual techniques for the dissemination of training materials.

Until assigned to Letterkenny, he commanded the 29th General Support Group in Vietnam, following an assignment as chief of the Politico-Military Division, Office of the Joint Chiefs of Staff. He served five years with OJCS, working with other agencies in analyzing critical security questions. Most of his work related to nuclear missile systems.

He holds a BS degree in business administration from Northeastern University in Boston, Mass., an MBA from Babson College, and a master's in international affairs from George Washington Univ.

HARRIS SUCCEEDS HODGES AS APG COMMANDER

COL Walter R. Harris assumed command of Aberdeen (Md.) Proving Ground following the recent retirement of COL Warren D. Hodges.

COL Harris recently completed a tour of duty as commanding officer of the U.S. Army Combat Developments Command Field Artillery Agency, Fort Sill, Okla.

Graduated from the United States Military Academy in 1944, he has a master's degree in mechanical engineering from Johns Hopkins University. His military schooling includes the Army Command and General Staff College (C&GSC) and the Army War College.

Assignments since 1968 have included senior adviser and detachment commander of the U.S. Military Assistance Command in Vietnam, and commander of the 1st Training Brigade, U.S. Army Training Center, Fort Bliss, Tex.

Among his military honors are the Legion of Merit with two Oak Leaf Clusters, Bronze Star Medal, Air Medal and the Army Commendation Medal with OLC.

COL Walter R. Harris

Wary Assumes Duties as MUCOM Chief of Staff

COL William D. Wary, since 1970 the head of the Manufacturing Technology Directorate, U.S. Army Munitions Command (MUCOM) Dover, N.J., is the new MUCOM chief of staff.

COL John L. Johnson, who held that title, has been appointed a special assistant to the commanding general.

Commissioned in the Ordnance Corps after graduating in 1943 from Officers Candidate School, Aberdeen (Md.) Proving Ground, COL Wary has completed the Logistician's Management Course, and the C&GSC residency course.

Assigned to the Army Ammunition Procurement and Supply Agency, Joliet, Ill., 1966–69, he served as chief of Procurement and then as assistant commander for Procurement and Production.

In the Republic of Vietnam, he was the chief of staff, Saigon Support Command, until reassigned to HQ Munitions Command.

Other overseas duty includes service in Europe, 1944–45; Korea, 1951–52; Germany, 1957–60 and 1963–66.

COL William D. Wary

Grace Bodie Joins Research Institute Staff

Grace C. Boddie, former comptroller and chief of research support management at the Army Research Office, Durham, N.C., has joined the Research Triangle Institute staff as a senior contracts specialist.

A Department of the Army civilian for 19 years, and a former lieutenant commander in the WAVES, Mrs. Boddie has law degrees from Duke University and is a graduate of Longwood College. She previously served as executive secretary of the National Advisory Committee for the Junior Science and Humanities Symposia Program.

Nichols Assigned as Frankford Deputy

COL Charles K. Nichols, a recent returnee from Vietnam where he was chief of the Materiel Division, Office of the Deputy Chief of Staff for Logistics, is the new deputy commander of Frankford (Pa.) Arsenal.

During 1970–71 he headed the Plans and Analysis Directorate, U.S. Army Tank-Automotive Command (TACOM), Warren, Mich., following 1968–70 service as commander of the 172d Support Battalion, Fort Richardson, Alaska and on the G-4 staff of U.S. Army, Alaska. He was Combat Development officer, Weapons Directorate, Combat Developments Command (CDC) at Fort Belvoir, Va. (1965–67).

COL Nichols has a BS degree in mechanical engineering from Massachusetts Institute of Technology and an MS in business administration from Babson College, Babson Park, Mass.

A graduate of the Command and General Staff College, COL Nichols rose through the ranks after enlisting in the Army in 1942. Graduated from the Infantry Officers Candidate School in 1945, he has served as a commander at detachment, company and battalion level and in various positions at brigade and major command level.

His decorations include the Legion of Merit with Oak Leaf Cluster and the Army Commendation Medal.

Laird Designates de Poix New DIA Director

Secretary of Defense Melvin R. Laird has announced the promotion of Vice Adm Vincent P. de Poix, U.S. Navy, formerly the deputy to Director, Defense Intelligence Agency, to succeed LTG Donald V. Bennett, U.S. Army.

GEN Bennett's reassignment as CG of the Eighth United States Army, Korea, and promotion to 4-star rank was effective Sept. 1.

Admiral de Poix was born on Aug. 13, 1916, in Los Angeles, Calif., and prior to his DIA assignment commanded the Second Fleet.

Secretary Laird also announced that President Nixon has nominated MG John R. Deane Jr., United States Army, for promotion to 3-star rank and assignment as Deputy Director, DIA. GEN Deane was reassigned from duty as Deputy Assistant Chief of Staff for Force Development, Washington, D.C. He was born June 8, 1919, in San Francisco, Calif.

HumRRO Trains Vietnamese Officer

LTC Nguyen Duc Than, chief of the Central Training Command (CTC), Training Research and Development (TR&D) Office, Republic of Vietnam Armed Forces, has started eight weeks of training with the Human Resources Research Organization, Alexandria, Va.

Upon his return to Vietnam on Jan. 1, LTC Than will develop and implement a major long-term program designed to develop the TR&D Office into a CTC division by FY 1976. Four weeks of his training will be at HumRRO's Division 1 in Alexandria.

One week will be spent at each of three HumRRO field units—Division 2 at Fort Knox, Ky., Division 3 at Monterey, Calif., and Division 4 at Fort Benning, Ga. He will divide the last week between Division 5 at Fort Bliss, Tex., and Division 6 at Fort Rucker, Ala. His visit is under the auspices of the Military Assistance Service funded program for Vietnam.

HDL Deputy Lab Chief Accepts Vietnam Duty

An assignment as deputy chief of the Electromagnetic Effects Laboratory of the Harry Diamond Laboratories ended recently for LTC Peter D. Booras when he departed for his second tour in Vietnam.

Before his current assignment, he served two years with the Office of the Chief of Research and Development. Since 1971 he has been assigned to the Army's Lead Laboratory Mission in Nuclear Weapons Effects and stationed at the HDL facility in Woodbridge, Va.

Graduated from the U.S. Military Academy at West Point in 1955, he obtained his MS in 1964 from Georgia Institute of Technology, and since 1971 has taken courses at the Armed Forces Staff College in Norfolk, Va.

His awards include the Silver Star, four Bronze Stars, the Meritorious Service Medal, a Vietnamese Honor Medal, two Crosses of Gallantry, the Valorous Unit Award, and the Senior Parachutist Badge.

LTC Peter D. Booras

Kirkpatrick Selected for Service on ISPEC

Daune M. Kirkpatrick has been named to serve on the Interagency Scientific Products Evaluation Committee (ISPEC), which provides technical assistance to the General Services Administration in procuring and distributing scientific equipment and products to federal agencies.

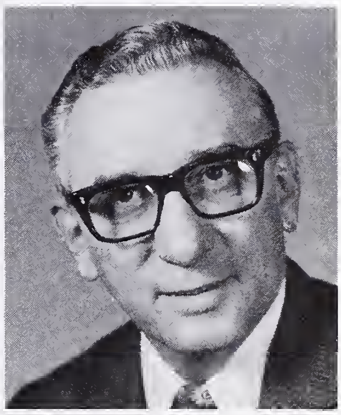
To insure that manufacturers' products meet their needs, the ISPEC directs its attention towards development of specifications, standards and test requirements on instruments and supplies used in federal scientific, chemical and medical research and development laboratories.

Kirkpatrick will provide the committee with technical skills gained in more than 25 years of scientific product experience. After serving four years as a flight engineer in the U.S. Army Air Corps during World War II, he was employed as a toolmaker with the Glenn L. Martin Co., Baltimore, until 1947. He then worked four years as a chemical analyst in raw materials research for the Bethlehem Steel Co., Sparrows Point, Md.

Since starting his Civil Service career at Edgewood Arsenal in 1951, he has served as a maintenance superintendent and cataloger. Currently, he is chief of the Standardization Branch, Directorate of Development and Engineering.

Chaired by the deputy commissioner for the Federal Supply Agency, the ISPEC membership represents 11 other government agencies. These include the Atomic Energy Commission, the Environmental Protection Agency, the National Aeronautical and Space Agency, the National Oceanic and Atmospheric Administration and the Veterans Administration.

Others are the Departments of Defense, Agriculture, Commerce, Transportation, Interior, and Health, Education and Welfare.



Daune M. Kirkpatrick

NLABS Announce New Deputy Commander

COL Harry L. Corkill Jr., until recently the commander of the 46th General Support Group, Fort Devens, Mass., is the new deputy commander of the U.S. Army Natick (Mass.) Laboratories.

A veteran of 28 years of Army service, he commanded Quartermaster and Airborne companies until 1957. Then he became the division quartermaster, 82d Airborne Division, Fort Bragg, N.C.

He has served as an airborne adviser in Vietnam (1959–61); CO for three years of the U.S. Army Aerial Support Center, St. Andre, France; in 1966 as CO, 15th Supply and Service Battalion, 1st Cavalry (Airmobile) Division, Vietnam; chief, Logistics Division, Office of the Deputy Chief, Joint United States Military Advisory Command, Thailand (1969–71); deputy commander and (later) chief of staff, 12th Support Brigade, Fort Bragg, N.C.

COL Corkill has attended the University of Maryland, the Army War College and the Army Command and General Staff College. His military awards comprise a very long list.

LTC Dean Directing White Sands Instrumentation

LTC James C. Dean, a 23-year Army veteran, has been named director of the Instrumentation Directorate, White Sands (N. Mex.) Missile Range. Until recently he served with the Directorate for Research, Development and Engineering, HQ Army Materiel Command, Washington, D.C.

His overseas assignments have included duty with the 97th AAA Group, Okinawa; 3d Battalion, 18th Artillery, Europe; 6th Battalion, 37th Artillery, Korea; and HQ Military Assistance Command, Vietnam.

LTC Dean has a bachelor's degree in education from the University of Omaha and is a graduate of the Army Command and General Staff College.

Bulletin Board . . .

Senate Approves Science Board Nominees

President Nixon's nomination of seven new members and reappointment of one member to the National Science Board, National Science Foundation, was confirmed Sept. 7 by the U.S. Senate. Appointees and retiring members are:

- *Dr. Wesley G. Campbell,* of Los Altos Hills, Calif., economist, director of the Hoover Institute on War, Revolution and Peace, Stanford, Calif., who succeeds Thomas F. Jones Jr.
- *Dr. T. Marshall Hahn Jr.,* president, Virginia Polytechnic Institute and State University, Blacksburg, Va., who succeeds Charles F. Jones.
- *Dr. Anna Jane Harrison,* professor of chemistry, Mount Holyoke College, South Hadley, Mass., who succeeds Horton Guyford Stever.
- *Dr. Hubert Heffner,* of Stanford, Calif., engineer, professor of applied physics, Stanford University, Calif., who succeeds Athelstan F. Spilhaus.
- *Dr. William H. Meckling,* of Pittsford, N.Y., economist, dean, College of Business Administration, University of Rochester, Rochester, N.Y., who succeeds Emanuel R. Piore.
- *Dr. William A. Nierenberg,* director, Scripps Institute of Oceanography, La Jolla, Calif., who succeeds Richard H. Sullivan.
- *Dr. Russell D. O'Neal,* of Ann Arbor, Mich., executive vice president for aerospace, Bendix Corp., Southfield, Mich., who succeeds Robert S. Morison.
- *Dr. Joseph M. Reynolds,* professor of physics and vice president for instruction and research, Louisiana State University, Baton Rouge, La., who was reappointed.

The National Science Board and the director constitute the National Science Foundation. The board is composed of 24 members eminent in the fields of the basic sciences, medical sciences, engineering, agriculture, education, or public affairs, and the director ex officio. The board elects for 6-year terms a chairman and vice chairman from among its members.

The board serves the government by considering the national scientific needs, determining policies and programs for the foundation, and recommending over-all national policies for promoting basic research and education in the sciences.

National Narcotics Intelligence Office Created

To combat increasing drug traffic more effectively, President Nixon announced creation of a National Narcotics Intelligence Office early in October, along with a proposal to Congress to approve $135.2 million in additional funds for intensified control effort.

The NNIO mission will include analyzing and disseminating intelligence on drug traffickers collected by agents of existing organizations such as the Bureau of Narcotics and Dangerous Drugs, and the Bureau of Customs.

The BNDD agents operate throughout the United States and overseas. They assist local law enforcement agencies overseas in their programs and train operatives in investigative seizure techniques.

To control border trafficking in drugs, the U.S. Customs Bureau has added new equipment such as additional vehicles, boats and aircraft.

Another part of the control drive is the crackdown of the Internal Revenue Service to hit at those who make illegal profits from narcotics, but never actually handle them. During FY 1972 the IRS levied tax assessments of more than $54 million and participated in some 469 tax investigations.

Another extension of the long arm of the law is the Office of Drug Abuse Law Enforcement (DALE), an agency operating in 33 target cities to investigate and prosecute drug dealers. Since it was created in January 1972, DALE has made more than 3,000 arrests and identified some 3,000 drug pushers.

Statistics released by the White House for FY 1972 show the seizure by BNDD and Bureau of Customs agents of 1,626 pounds of heroin, along with 339,587 pounds of marijuana, 882 pounds of cocaine, 9,583 pounds of hashish, and 241 pounds of other narcotics such as morphine and codeine.

SCIENTIFIC CALENDAR

Northeast Electronics Research and Engineering Meeting, sponsored by IEEE, Boston, Mass., Nov. 1–3.

National Meeting of the Operations Research Society of America, Atlantic City, N.J., Nov. 8–10.

Symposium on Flexible Packaging for Heat Processed Foods, sponsored by AMC and DSA, Chicago, Ill., Nov. 9–10.

Joint Meeting of the American Nuclear Society and the Atomic Industrial Forum and Atom Fair, sponsored by ANS, Washington, D.C., Nov. 12–16.

7th Annual Symposium, Automatic Support Systems for Advanced Maintainability, sponsored by IEEE, Philadelphia, Pa., Nov. 13–15.

21st Conference on Microbiological Deterioration of Military Materiel, sponsored by AMC, Natick, Mass., Nov. 14–16.

1st International Conference on Modulation Spectroscopy, sponsored by ARO-D and NSF, Tucson, Ariz., Nov. 23–26.

8th Annual International Aviation Maintenance Symposium, sponsored by FAA, Oklahoma City, Okla., Nov. 28–30.

2d International Conference on Digital Satellite Communications, sponsored by INTELSAT, Paris, France, Nov. 28–30.

Fall Computer Conference, Los Angeles, Calif., Nov. 14–16.

Magnetism and Magnetic Materials Conference, Denver, Col., Nov. 28–Dec. 1.

International Symposium on the Control of Lice and Louse-Borne Diseases, sponsored by OTSG, Pan American Health Organization, AFEB, Fogarty International Center and NIH, Washington, D.C., Dec. 4–6.

TACOM Gains New Track-Suspension Lab

Official takeover of a new $2.5 million track and suspension laboratory by the U.S. Army Tank-Automotive Command (TACOM), Warren, Mich., was marked by a recent ribbon-cutting ceremony with MG Joseph E. Pieklik, TACOM CG, officiating.

First of its kind for the U.S. Army and the first laboratory building constructed at HQ TACOM since 1956, the new facility has some 45,000 square feet of floor space.

Equipment being installed consists mainly of hydraulically actuated test fixtures. These shaker-type platforms will be used for testing frame, suspension and track components and systems under simulated dynamic field conditions. Test equipment will be capable of supporting entire military vehicles weighing as much as 60 tons.

The field test simulation of TACOM's new laboratory is expected to reduce sharply the Army's tracked vehicle operation expenses.

Watervliet Engineer Elected ASTM Secretary

Joseph F. Throop, a Watervliet (N.Y.) Arsenal research engineer, is the newly elected secretary of the 100-member Committee on Fatigue of the American Society for Testing and Materials (ASTM).

The society is an international organization dedicated to materials engineering and standardization of specifications and methods of testing.

Throop heads the Fracture Mechanics Laboratory of the Materials Engineering Division at Watervliet Arsenal. As secretary of the ASTM committee, he also will arrange programs and conduct symposiums at national meetings.

The committee develops fatigue testing specifications for materials and products adopted by industries, government agencies and consumer organizations. ASTM standards are used throughout the world.

Throop is a 1938 graduate of Rensselaer Polytechnic Institute where he also earned a master's degree in mechanics. He joined the arsenal research staff in 1965, has authored several papers in ASTM technical publications, and was one of a group of arsenal scientists who won U.S. Army R&D Achievement Awards in 1971.

Joseph F. Throop

Awards . . .

LEGION OF MERIT. *COL Henry F. Grimm Jr.* received a first Oak Leaf Cluster to the Legion of Merit (LM) when he retired recently as deputy chief of staff for analysis, U.S. Army Test and Evaluation Command. MG Charles P. Brown, TECOM commander, presented the medal.

LTC Hubert W. Lacquement, Combat Materiel Division, Office of the Chief of Research and Development (OCRD), was awarded the LM for service in 1971–72 as chief, Operations Branch, Policy Operations and Materiel Division, U.S. Military Assistance Command, Vietnam. Chief of Research and Development LTG William C. Gribble Jr. presented the award.

MERITORIOUS SERVICE MEDAL. *LTC Robert B. Henry,* commanding officer and deputy director of the U.S. Army Materials and Mechanics Research Center (AMMRC), Watertown, Mass., was awarded the Meritorious Service Medal (MSM).

The award was made for 1969–72 outstanding performance as a staff officer in the Nuclear, Chemical and Biological Division, OCRD. Dr. Alvin E. Gorum, director of the AMMRC, made the presentation.

The citation reads in part: "He was responsible for the formulation of plans and programs and implementation of the Army's Chemical Warfare and Biological Defense R&D programs and goals."

LTC Douglas A. Hughes was awarded the MSM for service as deputy commanding officer, U.S. Army Aberdeen (Md.) Research and Development Center. COL Rudolph A. Axelson, center commander, made the presentation to Hughes, who was reassigned to the Office, Chief of Engineers, Washington, D.C.

JOINT SERVICE MEDAL. *COL Jerry L. Lauer,* deputy director of Plans and Programs, OCRD, recently received the Joint Service Commendation Medal (JSCM). LTG William C. Gribble Jr. presented the award and a citation which recognized COL Lauer's achievements as chairman of the Department of Defense Air Munitions Requirements and Development Committee during 1971–72.

LTC William J. Fiorentino, Management and Test Division, OCRD, received a second Oak Leaf Cluster to the JSCM. Army Deputy Chief of Research and Development MG George Sammet Jr. presented the medal. The citation acclaimed 1969–71 service as a military college instructor at the Defense Weapon Systems Management Center, Air Force Institute of Technology.

SP5 Wrick Essman, Picatinny Arsenal, has been awarded the JSCM for distinguished and outstanding service while previously assigned to HQ, Eastern Area, Military Traffic Management and Terminal Service, Brooklyn, N.Y. COL Arthur L. Knipp Jr., CO of Picatinny Arsenal made the presentation.

ARMY COMMENDATION MEDAL. *CPT Warren T. Brennan,* MC, U.S. Army Medical Research and Development Command, is a recent recipient of the Army Commendation Medal (ARCOM), presented by MG Richard R. Taylor, CG of the command. The citation recognizes CPT Brennan for technical competence in making available a wide range of data for research.

CPT Robert J. York received the ARCOM for his performance as a research chemist at the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.

The presentation was made by COL Bennett L. Lewis, commanding officer, prior to CPT York's departure for a new assignment.

MASTER ARMY AVIATOR'S BADGE. *LTC Allen G. Truby,* staff officer with the Electronics Warfare Branch, Command Systems Division, OCRD, is a recent recipient of the Master Army Aviator's Badge. BG Sylvan E. Salter, Director of Developments, presented the award.

MISCELLANEOUS AWARDS. Dr. Frederick W. Rohde is the recipient of a $350 Sustained Superior Award for his performance in dual assignments as technical group leader for the Defense Navigation Satellite System Working Group and as an adviser for the Long Range Position Determining System, U.S. Army Engineer Topographic Labs.

Larry N. Scartz received a Sustained Superior Performance Award and $300 for duties as assistant project engineer with the Inertial/Optical Survey Equipment Branch. He is also with the U.S. Army Engineer Topographic Laboratories.

Dr. Grubbs Elected as Fellow Of Institute of Math Statistics

Dr. Frank E. Grubbs, chief operations research analyst of the Ballistic Research Laboratories at Aberdeen Proving Ground, Md., has been elected a Fellow of the Institute of Mathematical Statistics. He has also been designated a Certified Reliability Engineer of the American Society for Quality Control.

The selection makes Dr. Grubbs a Fellow of all technical or scientific societies with which he is affiliated that confer this honor.

Earlier this year, Dr. Grubbs won the Shewhart Medal of the American Society for Quality Control. In 1964 he was awarded the Samuel S. Wilks Memorial Medal, which is sponsored jointly by the Army and the American Statistical Association. A year before, he received the Army Decoration for exceptional Civilian Service.

Picatinny V-E Saves 1.6 Million With Adoption of Navy Warhead

Two Picatinny (Dover, N.J.) Arsenal employes saved an estimated $1,691,500 in FY 72 with a proposal to replace the M230 practice warhead for the 2.75-inch rocket with the Navy's WTU-1-B version.

Value engineered modifications, which include changes in weight, exterior dimensions and protective finish, give the Armed Services an improved warhead at less cost.

Shown with the Navy warhead are, left, Edward Krajkowski, chemical engineer, project leader, and Edwin Mitrowski, project engineer. Both are with the Munitions Engineering Division. In FY 72, they completed two other value engineered projects, dealing with flechettes for the 2.75-inch rocket.

Picatinny Arsenal Wins DoD Conservation Award

High-ranking officials joined in recent recognition of Picatinny Arsenal for its 1970 conservation program when a Department of Defense Meritorious Achievement Citation was presented—adding to similar awards to the arsenal for 1966, 1968 and 1969.

Secretary of Defense Melvin R. Laird noted in the citation that the arsenal's outstanding conservation program "reflects great credit upon the installation, the personnel thereof, the Army and the Department of Defense."

Deputy Chief of Staff for Logistics LTG Joseph M. Heiser Jr. said the citation attests to "the vigorous efforts made by the installation to promote fish and wildlife activity, create new recreational opportunity, and further the application of conservation and management principles."

GEN Henry A. Miley Jr., Army Materiel Command CG, expressed his appreciation as did MG Erwin M. Graham Jr., Munitions Command CG. Picatinny Arsenal is at HQ MUCOM, Dover, N.J.

Each year, Defense Department installations throughout the United States submit reports with accompanying photographs of their achievements in land, forest, wildlife and landscape management.

DoD committees screen the entries and select winners based on accomplishments in woodland improvement and protection, wildlife management, weed control, grass, tree and shrub planting, soil improvement, safety and insect control.

AMC Cost Reduction Savings Exceed FY 72 Quota Set by DA

Army Materiel Command (AMC) cost reduction savings of $329 million have exceeded by 165 percent the FY 1972 AMC quota set by the Department of the Army. This year's achievements are expected to yield 3-year (FY 72–74) total savings of $557 million.

The Army Cost Reduction Program is aimed at reducing costs in 12 major management areas of emphasis. These include Major Items of Equipment; Supply, Data, Procurement, Telecommunications, Transportation and Traffic, Equipment Maintenance and Real Property Management; Value Engineering, Schools Education and Training, Preservation, Packaging and Packing and General Management Improvement.

AMC has met or exceeded its annual CR goals in each of the 10 years the program has been in existence.

AMC's FY 72 goal of $200 million was exceeded by the highest margin since 1967. The entire Army-wide goal was set at $300 million.

LWL Scientist Nominated for $10,000 Award

Milton Cutler

Nominations for a $10,000 Rockefeller Public Service Award include Milton Cutler, recently retired chief of the Advanced Development Division, U.S. Army Land Warfare Laboratory (LWL). Cutler is the only Department of the Army nominee.

Cutler's selection is based on achievements during a 30-year career as a U.S. Army scientist, including the direction of a broad program of chemical, physical, biological and engineering research and development, including materiel for use in counterinsurgency operations.

The first U.S. Army LWL liaison officer in Vietnam, a volunteer from April to June 1963, he has served as consultant and technical adviser to various government and professional agencies. He is author or principal coauthor of about 50 technical papers and reports, and holds several patents for inventions.

Among LWL projects under his guidance was the development of a "people-sniffer" that is hypersensitive to internal combustion engine exhaust as well as to various combustible gases—used for detection of the enemy in Vietnam. A plasma chromatograph that gives specific responses to both heroin and dynamite, also developed under his direction, is being investigated as a multichemical detector; also, a bioluminescent personnel detector that can "sense" heroin.

Two dogs trained at the LWL in Cutler's division to detect hidden explosives were delivered to the New York City police department on May 1, 1971. Cutler also planned and conducted for key law enforcement officials a symposium on drug detection in May 1971. For other notable results, he received an Army R&D Achievement Award in 1966 and the Meritorious Civilian Service Award in 1968.

Cutler served briefly as chief of the Chemical and Explosives Branch, LWL, before moving to the Advanced Development Division. Before coming to LWL in 1962, he was employed for seven years at the Chemical Research and Development Laboratories, Edgewood Arsenal, Md., where he became chief of the Weapons Research Division.

From 1941 to 1945, Cutler was employed at Huntsville, Ala., where he served as superintendent of the Plant Development Section, Redstone Arsenal.

Graduated from Brooklyn College in 1940 with a BS degree in chemistry, his graduate studies at the Polytechnic Institute of Brooklyn were interrupted by World War II.

The Rockefeller Public Service Awards have been administered for the past 20 years as part of a program to strengthen the public service. They are given annually to men and women whose careers in the Federal Government have been marked by sustained excellence in service to the nation.

Normally, five awards are given each year; one each in five broad fields of government activity. One of these fields is Professional Accomplishment and Leadership, which is designed to recognize the man or woman whose distinction lies primarily in professionalism.

Nominations are limited to civilians who have been federal employes for 15 years or more, are in grades GS-16 and above, and are between 45 and 60 years old.

Kupelian Nominated for Aerospace Man of Year

Vahey S. Kupelian, an assistant director of the U.S. Army Advanced Ballistic Missile Defense Agency, Arlington, Va., has been nominated for the Electronics and Aerospace Systems Convention (EASCON) Aerospace Service Award—known also as the "Aerospace Man of the Year" award.

Kupelian is program manager of ABMDA's Area Defense Program and formerly was chief of its Missile Development Division. Until he joined the ABMDA staff he was chief of the Mechanics Branch, Advanced Research Projects Agency (ARPA). He also served as program manager of the ARPA Hard Point Defense and Interceptor Technology Programs.

His experience includes duty as chief engineer for missile systems of the Navy's Weapons Plant, and director of engineering of the Naval Ordnance Experimental Unit at the National Bureau of Standards.

Kupelian recently was a U.S. Army representative at the 13th Congress of the International Union of Theoretical and Applied Mechanics in Moscow, Russia.

His industrial background includes propulsion and flight test assignments at Pratt and Whitney Aircraft and at Goodyear Aircraft. He was chief of propulsion as well as flight test and project director on various aircraft and missile developments with Goodyear, including the F2G airplane, which is the final record holder of the Thompson Trophy air classic.

Kupelian's nomination for the EASCON Aerospace Service Award is based on his work in the ABMDA UpSTAGE (Upper Stage Acceleration and Guidance Experiment) program. He was the initiator, technical director and manager of this 10-year program.

Conducted for ABMDA by the McDonnell-Douglas Astronautics Corp., UpSTAGE produced increases in interceptor maneuver and responses about an order of magnitude beyond the then current state-of-the-art capabilities—thus demonstrating the feasibility of developing ballistic missile defense interceptors capable of destroying the most severely evasive targets.

Kupelian has a BS degree from Massachusetts Institute of Technology and is a member of Sigma Tau, and an Associate Fellow of the American Institute of Aeronautics and Astronautics as well as a member of its Technical Committee on Missile Systems. He has received the Secretary of Defense Meritorious Civilian Service Medal and various Army and Navy commendations.

Vahey S. Kupelian

Edgewood Employes Serving On Interagency Committee

Edgewood Arsenal has five civilian employes serving on committees in the Safety and Environmental Protection Working Group (SEPWG) of JANNAF's (Joint Army-Navy-NASA-Air Force) Interagency Propulsion Committee.

In addition, W. Paul Henderson, a chemical engineer in the arsenal's Manufacturing Technology Directorate, has been the Army's representative on the JANNAF Technical Steering Committee since 1953.

Other Edgewood Arsenal employes' SEPWG committee assignments are: Harvey Tannenbaum, a supervisory chemist and Alan Hilsmeier, arsenal health physicist and a member of the technical director's staff, Environmental Protection; Joseph F. Voeglein, safety engineer, Transportation; John P. Fiala, mechanical engineer, Hazard Evaluation.

Albert K. Becher, chief of the arsenal's Safety Office, is an alternate on the Technical Steering Committee.

The stated purpose of the working group is to assemble information on the hazards, protection methods, and the materials and equipment needed to handle, store and transport propellants, and fueling of rockets.

"The ultimate objective of the working group," Henderson said, "is to publish this information in a manual for use by both industrial and government agencies."

HumRRO Issues Technical Reports

The Human Resources Research Organization (HumRRO) has announced that a 1972 *Bibliography of Publications* will not be published.

Instead, a new *Supplement* will be issued to the "as of 30 June 1971" bibliography, and will cover publications produced by HumRRO from July 1, 1971 through June 30, 1972.

Copies of the supplement will be sent to addresses of last year's bibliography on initial distribution. HumRRO explained that an "extra" supply will be printed to last until a new bibliography comes out.

Tropical Canine Pancytopenia:

WRAIR Experiments Indicate Antibiotics May Effectively Treat Deadly Dog Disease

One of the deadliest diseases to the U.S. Army canine corps in Southeast Asia operations—tropical canine pancytopenia (TCP)—may be treated effectively by the use of broad spectrum antibiotics.

This conclusion is based on recent laboratory experiments conducted by Walter Reed Army Institute of Research (WRAIR), Washington, D.C., in conjunction with contract effort by researchers at the University of Illinois.

Laboratory studies are in progress to evaluate the efficacy of antibiotics in the chronic stages of TCP. Dogs that have recovered from the disease after being treated with antibiotics are still subject to reinfection. A dog that recovers from the disease remains infected a long time—in laboratory observations as long as two years—during which a relapse may occur. Tetracycline has proved an effective prophylactic and therapeutic agent in experiments.

TCP is a major veterinary problem in the use of military dogs in many tropical and subtropical areas. About 300 U.S. military dogs, mostly German Shepherds, have died of the disease in Southeast Asia operations since July 1968.

The disease has also affected military and privately owned dogs in the Middle East, the Virgin Islands, Puerto Rico, Panama, Texas and Florida, says MAJ David L. Huxsoll of the Division of Veterinary Medicine, Walter Reed Army Institute of Research, Washington, D.C. TCP is potentially a major veterinary medical problem in the use of military dogs in many tropical and subtropical areas.

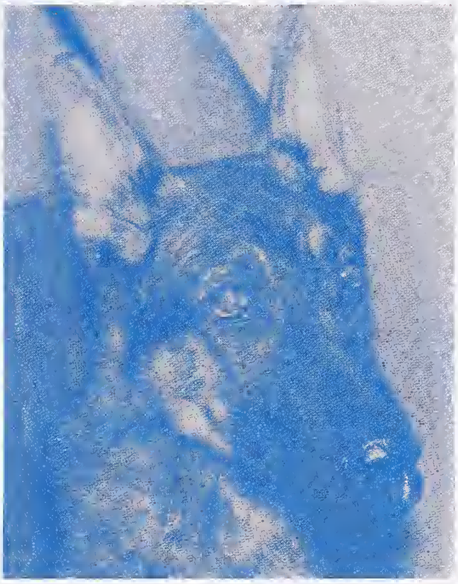
Characterized by hemorrhage, severe emaciation and persistent infection, the disease occurred as an epidemic in Vietnam in late 1968 and early 1969, jeopardizing the operational efficiency of units dependent on military dogs. To counter this threat a high priority investigation of this unusual disease was immediately organized at WRAIR.

With the collaboration of the 9th Medical Laboratory, the 936th Small Animal Hospital and other veterinary units in the Republic of Vietnam, studies were undertaken at WRAIR to determine the cause, pathogenesis, treatment and control of TCP.

Within six months after studies were initiated, WRAIR researchers identified *Ehrlichia canis,* a rickettsia, as the causative agent. The organism has been recovered consistently from dogs affected with TCP from diverse geographical locations.

In addition, the pathogenicity of the disease in German Shepherd and Beagle dogs has been examined; *Rhipicephalus sanguineus,* the brown dog tick, has been shown to be a vector. Red and gray foxes have been experimentally infected and are considered to be potential reservoir hosts. The ultrastructure of the organism also has been examined.

Under a United States Army Medical Research and Development contract, investigators at the College of Veterinary Medicine, University of Illinois—working in close collaboration with WRAIR researchers—succeeded in propagating in cell culture, *Ehrlichia canis,* for the first time.



TCP signs clearly evident in this dog include bleeding from the nose and corneal opacity. Dogs displaying such signs usually die in a few days despite antibiotics.

This accomplishment enabled scientists to develop an indirect fluorescent antibody test for serological diagnosis of the disease. The test is currently being used to confirm diagnoses in military dogs and identify dogs that are carriers.

Laboratory dogs also have been experimentally infected with TCP. Epidemiologic investigations at WRAIR have provided evidence that the disease is transmitted by ticks.

In the first stage of the disease, following an incubation period of 10–15 days, the dog's temperature may go from a normal 101° to 105–106°. The onset is also characterized by anorexia, depression, lowered red and white blood cell counts, and elevation of the erythrocyte sedimentation rate. The length of the febrile period varies from a few days to several months, persisting in most instances for 15–25 days.

A sudden onset of epistaxis (nosebleed) is often the first indication that a dog is affected with TCP. In some instances epistaxis is the only apparent clinical sign. However, it may be accompanied by one or more of the following signs: anemia, edema of limbs; loss of weight; hemorrhages on the abdomen, oral cavity and conjuctiva; loss of appetite; dyspnea; fever; corneal opacity; lethargy; enlargement of lymph nodes; and weakness.

Death often occurs within a few days following onset of hemorrhage. Some dogs survive the initial hemorrhagic episode; however, in many of these instances epistaxis recurs and the dog eventually succumbs to the disease.

Some dogs become chronic bleeders and have intermittent episodes of mild epistaxis over a period of several months prior to death. Coagulation time and prothrombin time are normal; however, bleeding time is prolonged. Severe reduction in red blood cells, white blood cells and blood platelets occurs. Blood platelets are essential in control of bleeding.

A number of dogs with TCP do not develop epistaxis (bleeding). Blood changes in these dogs are similar to those observed in dogs with epistaxis but clinical signs of hemorrhage do not occur. These dogs often become severely debilitated prior to death.

Dogs with TCP usually have a history of a febrile episode occurring two or more months prior to the onset of epistaxis. In some dogs this febrile episode may be very mild and may go unrecognized. The fever, usually lasting 10–15 days but sometimes lasting several months, may be accompanied by loss of appetite, decreased stamina, severe weight loss and edema of the limbs. A reduction in the red blood cells, white blood cells and blood platelets occurs.

In a few instances mild epistaxis may also be evident during the febrile episode. Following this, the dog will usually regain a normal physical appearance. Abnormal hematological signs may persist and may be the only signs of disease prior to the onset of epistaxis.

In those dogs that die without clinical signs of hemorrhage, death may be attributable to extensive internal hemorrhage or secondary infections associated with severe anemia and reduction in white blood cells.

Experimental infections of *E. canis* in German Shepherd and Beagle dogs at WRAIR have produced evidence that the manifestations of *E. canis* infections are dependent upon the breed of dog.

Studies have confirmed that TCP is a severe manifestation of *E. canis* infection in certain breeds of dogs, particularly the German Shepherd. Experimentally infected German Shepherd dogs develop disease indistinguishable from the natural disease.

Dogs that survive may remain carriers for long periods of time. In laboratory studies dogs have remained infected during a 2-year observation period.

Although TCP has been observed most often in German Shepherds, dogs of other breeds are affected, such as the Labrador, Old English Sheep Dog, Schnauzer, Doberman, Collie and Poodle.

Studies are currently under way to determine the geographic distribution and incidence of TCP in the United States and throughout the world.

Army Schedules Information Exchange At Tri-Service Corrosion Conference

The U.S. Army will host the 1972 Tri-Service Corrosion Conference in Houston, Tex., Dec. 5–7.

A follow-up to two earlier related conferences, this year's meeting will provide an inter-service exchange and coordination of technical expertise on corrosion information.

Programed topics include High Temperature Oxidation and Sulfidation; Corrosion-Induced Cracking Phenomena; Aircraft and Missiles; Power Units; Armaments; Ammunition; Ships, Submersibles and Ocean Equipment; Electronic Equipment; and Non-Destructive Inspection.

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